SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y.. as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XLI.—No. 20. [NEW SERIES.] NEW YORK, NOVEMBER 15, 1879. [$3.20 per Annum. [POSTAGE PREPAID.]

AMERICAN INDUSTRIES.—No. 23.

THE MANUFACTURE OF GOLD PENS AND PENCILS.

The name Faber has been connected with the manufacture of pencils for more than a century. In the year 1761 Caspar Faber (the founder of the house) began the manufacture of Faber's pencils in the little village of Stein, near Nuremberg, Bavaria. In 1784 Anthony William Faber—whose name the firm bears to this day—succeeded his father Caspar Faber. Since the time of A. W. Faber the commercial relations of the house have extended to all commercial countries, and the Faber pencil is a familiar object in every household and place of business. In 1851 the late Mr. Eberhard Faber removed to this country, and established in this city the branch house in which is centered the trade of the whole of the United States, Canada, Mexico, South America, and the West Indies. It is not the purpose of this article to give the details of the history of this very successful house, nor to describe the manufacture of lead pencils, but to give an idea of the process of making gold pens and gold pen and pencil cases.

The New York office, which is shown in the upper portion of the engraving, is located at 718 and 720 Broadway, and different departments of the new factory for the manuture of gold pens and pencils are shown in the larger of the other views. Some of the recent styles of goods are shown in the small side engravings.

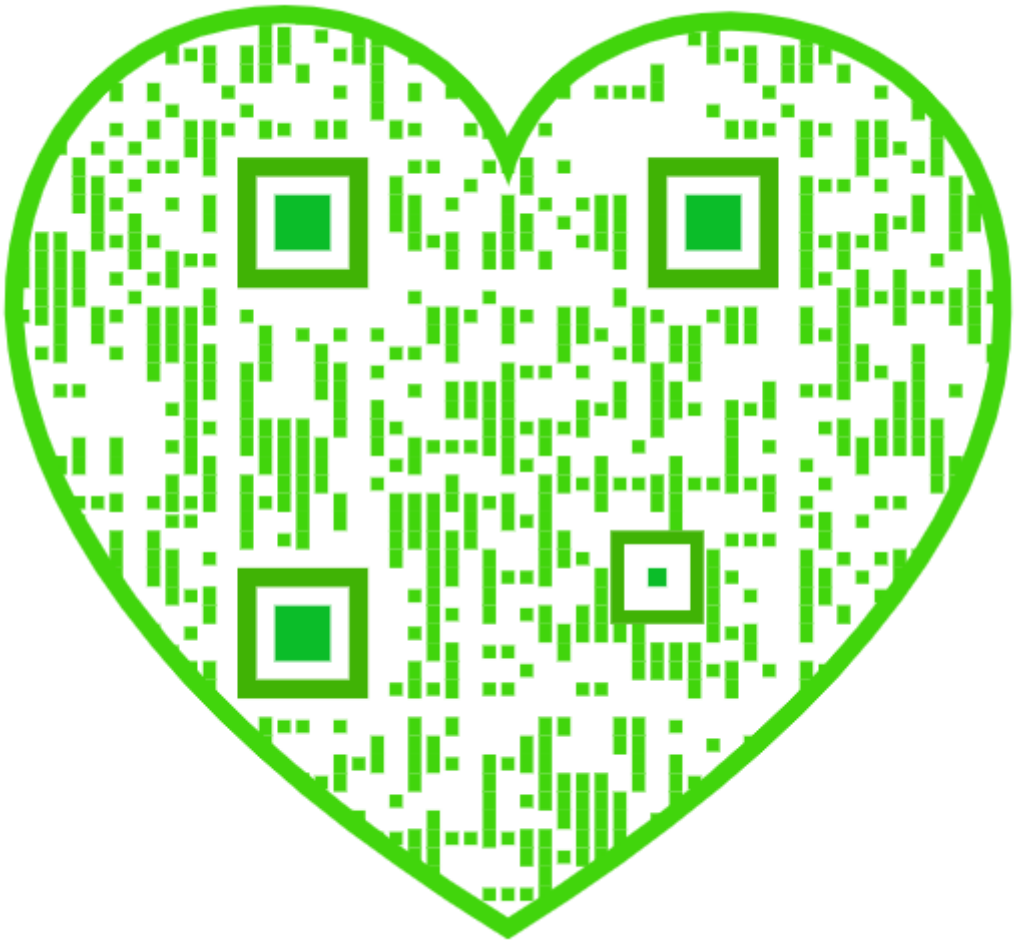
A gold pen seems a very simple thing, but there are many processes in its manufacture, all requiring an amount of skill that can be acquired only by long experience.

The gold used in this establishment is obtained in bricks from the United States Assay Office, and for pens it is

[*Continued on page* 309.]

FABER'S GOLD PEN AND PENCIL FACTORY.

© 1879 SCIENTIFIC AMERICAN, INC



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, postage included..... **$3 20**
One copy, six months, postage included **1 60**

Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis for every club of five subscribers at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

Remit by postal order. Address
MUNN & CO., 37 Park Row, New York.

☞ To Advertisers.—The regular circulation of the SCIENTIFIC AMERICAN is now **Fifty Thousand Copies** weekly. For 1880 the publishers anticipate a still larger circulation.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, with handsome cover, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, postage paid, to subscribers. Single copies 10 cents. Sold by all news dealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, postage free, on receipt of *seven dollars*. Both papers to one address or different addresses, as desired.

The safest way to remit is by draft, postal order, or registered letter.

Address MUNN & CO., 37 Park Row, N. Y.

Scientific American Export Edition.

The SCIENTIFIC AMERICAN Export Edition is a large and splendid periodical, issued once a month. Each number contains about one hundred large quarto pages, profusely illustrated, embracing: (1.) Most of the plates and pages of the four preceding weekly issues of the SCIENTIFIC AMERICAN, with its splendid engravings and valuable information; (2.) Commercial, trade, and manufacturing announcements of leading houses. Terms for Export Edition, $5.00 a year, sent prepaid to any part of the world. Single copies 50 cents. ☞ Manufacturers and others who desire to secure foreign trade may have large, and handsomely displayed announcements published in this edition at a very moderate cost.

The SCIENTIFIC AMERICAN Export Edition has a large guaranteed circulation in all commercial places throughout the world. Address MUNN & CO., 37 Park Row, New York.

NEW YORK, SATURDAY, NOVEMBER 15, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

Academy of Sciences, National. 313
Air torpedo, compressed..... 314
American industries*..... 303
Anti-vaccination folly..... 304
Architectural designs..... 314
Atropine and pilocarpine..... 312
Attraction 312
Aurora borealis..... 316
Brain of an anthropologist..... 309
Camphor, electrical..... 311
Carpeting the Mississippi..... 308
Cologne cathedral, completion of 308
Crusher, sectional cushioned*... 306
Do it well 312
Drawing apparatus, perspective* 307
Elevated railway nuisance..... 313
Elevated railways, cost of..... 310
Electrical generator, Edison's.305 308
Fire engine improvements..... 307
Flour, new process..... 308
Glassware, Roman*..... 311
Glue, liquid (1)..... 315
Grinding, high and low..... 308
Hair, treatment of the..... 312
Ice cave of Teneriffe..... 308
Ice yachts, speed of..... 309
Industries, American*..... 303
Ink for copying pads (5)..... 314
Inventions, mechanical..... 307
Inventions, miscellaneous..... 306
Inventions, recent, a few..... 310
Keeping the boys on the farm.... 312
Linen, to starch (7)..... 315
Live stock, abuse of..... 309
Locomotives, great, of Erie R. R. 311
Locomotive, the..... 310
Paper from grass..... 311
Pens and pencils, manuf. of*..... 303
Physical science, philosophy of.. 307
Pliocene man in California..... 314
Polyphemus, the 306
Printing telegraph, octoplex..... 306
Professional men, advice to..... 314
Puzzle for future geologists 308
Rainfall and forests..... 312
Skins, to soften (8)..... 315
Sleeping-car berths, improved*... 307
Stereotype composition, new..... 314
Stock car, reward for..... 304
Torpedo catcher, the..... 310
Velocities, high wind..... 312
Water supply of Philadelphia.... 304
Wax, to toughen (3)..... 315
Western Union telegraph..... 312
Window glass trade..... 313
Work and wages in Lowell..... 313

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 202,

For the Week ending November 15, 1879.

Price 10 cents. For sale by all newsdealers.

I. ENGINEERING AND MECHANICS.—The New Cunard Steamer Gallia. A detailed description of the hull and machinery of the last and most important addition to the Cunard fleet. 1 large illustration of the Gallia afloat. 6 figures.
The Severn Bridge. A full account of the dimensions, structure, and construction.
Machinery in Flour Mills—Cost and Depreciation. By A. J. WATERS.

II. ELECTRICITY, SOUND, ETC.—The Lontin Electric Light. The character and economy of the Lontin system. Practical tests.
Theory of the Telephone.

III. TECHNOLOGY AND CHEMISTRY.—The Polariscope as Applied to Sugar Manufacturing and Brewing. By J. STEINER. (Continued from No. 201.) 6 figures.
Formulæ for Perfumery. By ALEX. B. LEVI, Ph.G.
Azoic Coloring Matters. Artificial substitutes for turmeric berries, fustic, orchil, etc.

IV. MEDICINE, HYGIENE, ETC.—Anæsthesia under Pressure. Superior effects of a mixture of oxygen and nitrous oxides in an airtight chamber under slight pressure.
Cholera in Japan. History of the current epidemic. By Dr. D. B. SIMMONS, of Yokohama.
The Toxic Effects of Tea.

V. METALLURGY.—The Consolidation of Fluid Steel. By ALFRED DAVIS. A valuable paper read before the British Iron and Steel Institute.
Lead Fume—With a Description of a New Process of Fume Condensing. By A. FRENCH.
The Neutralizing of Phosphorus in Steel-like Metals. By RICHARD BROWN.

VI. BIOLOGY, EXPLORATIONS, ETC.—The Beginnings and Development of Life. Part I. By Prof. EDMUND PERRIER.
The Lich Observatory. Progress and prospects.
Nordenskjöld's Winter Experience and Observations. Professor Nordenskjöld's story of Arctic life and study on board the Vega and along the shores of Siberia.
The Action of Nature's Forces. Professor Geikie's Lectures at the Lowell Institute, Boston.
Development of the House Fly. By H. M. ROBSON. 4 figs.

VII. INDUSTRIAL ART.—Suggestive Ornaments for Decorative Painting. Thirteen figures of ornaments designed by O. Girard, Architect in Vienna, with directions for coloring.

VIII. BIOGRAPHY.—M. Viollet-Le-Duc. Sketch of the career of the celebrated French architect. One large portrait.

IX. MISCELLANEOUS.—Literature and Composition. By ELIZA A. BOWEN.
Science and the United States Navy. The contributions of the Navy to the advancement of Science.
Facts and Figures. Some curious illustrations of molecular and other magnitudes and motion.
Things that are Misnamed.
Habitual Criminals. Professor Lombroso's studies of the physical characteristics of the criminal classes.

FIVE THOUSAND DOLLARS REWARD FOR THE INVENTION OF A STOCK CAR.

At its recent meeting at Chicago, noticed at length in another column, the American Humane Association offered a prize of $5,000 for an improved stock car capable of carrying live animals long distances without needless suffering. The great object seems to be to obtain a car in which cattle, sheep, or hogs can be fed and watered while on the road, with room for the animals to lie down without risk of being trampled upon by others.

It appears from the investigations made by the agents of the association that the practice of frequent stoppages to allow transported stock to lie over for rest and refreshment, enjoined in many States by law, is largely disregarded, and when observed only adds to the sufferings of the animals. The stockyards are rarely furnished with suitable appliances for feeding or watering stock; too often the animals are crowded into filthy and muddy pens in which they cannot lie down either with comfort or safety; and the terror of the tortured animals when reloading is attempted leads them to resistance, wild rushes and frantic efforts to escape, in which they seriously injure each other and are brutally punished by the yard men. To obviate all this suffering, not to speak of the losses entailed by the killing and maiming of animals in the pens and on the road, the association calls for an improved car.

The resolution in which the prize is offered was introduced by the secretary of the association, Mr. Abraham Firth, of Boston, Mass., and reads as follows:

"*Whereas*, An urgent need exists of an improved cattle car in which animals can lie down and rest, and in which they can be watered and fed while on their journey to the markets, and be saved the suffering attendant upon loading and unloading from the cars, and at a serious loss of time to all having a pecuniary interest in the business; and

"*Whereas*, Objections are urged by the railroad companies against existing cars made to attain the ends named; and

"*Whereas*, We strongly believe that invention may be stimulated in this direction; be it

"*Voted*, That this association, recognizing its great importance, would urge all persons interested in its work to pledge themselves to pay a definite sum towards a prize for this object.

"*Voted*, That in the judgment of this meeting the prize ought not to be less than $5,000, and that six months' time should be given to all competitors to prepare specifications and models, and meet whatever requirements the judges of the prize shall name in their offer.

"*Voted*, That the Executive Committee of this association be requested to solicit pledges in this behalf from all persons interested in this specific aim, and be authorized to appoint the judges and to determine all the conditions, excepting only two: First, that the invention shall be the unembarrassed property of this association; and secondly, that the car so approved be offered without charge to all railway companies who will use it in all their live stock business."

A little consideration of the practical bearing of the closing stipulations will probably lead the association to rescind them. The object of the association being purely one of humanity, their interest lies in securing the speediest possible introduction of the reform they seek; and experience proves that an improvement which some one owns and is pecuniarily interested in securing its wide and immediate use, is far more likely to be speedily and generally adopted than one which is common property. In any case, whether the inventor chooses to surrender his patent or not, the subject is worthy of attention. A car which will satisfy the requirements of the association will meet the wants of a vast and rapidly growing traffic; and the superior condition in which it will deliver cattle after long journeys, to say nothing of the direct saving in the percentage of loss of life and in doing away with the loss of time incident to stoppages, will compel its adoption by cattle shippers whether they care for the humanity of the thing or not. It is needless to say that the patent on a car of such a character would be an exceedingly valuable property.

We have no figures at hand to show the exact amount of the live stock traffic of our great railways, but it is obviously enormous. The cattle, hogs, and sheep required to supply the markets of our great cities are to be numbered only by millions annually. Even the traffic involved in our export trade in animals is extremely large. At our great pork-packing centers in the West there were slaughtered last year about seven and a half million hogs, the larger portion of which had made more or less extended journeys by rail. The packing-houses of the seaboard States must have added many hundred thousand to these figures. Nearly two hundred thousand sheep were exported alive last year, and probably half as many horned cattle; this in addition to more than fifty million pounds of slaughtered beef, brought alive from the far West. And, it will be remembered, this carrying traffic in live stock is but in its infancy.

As an indication of what has been done toward meeting the demand which the Humane Association has brought so prominently before the public, the following description of a patented car examined by a committee of the association will prove of interest. The absence of facilities for feeding and watering the animals in transit, necessitating the frequent repetition of the objectionable and injurious process of unloading and reloading, would seem to be a fatal defect in its otherwise clever construction:

The size of the car is 8x30 in the clear. It contains a series of movable bars, so arranged that they may be moved up and down at pleasure through slatted standards. After the car is loaded and the doors closed, the bars are let down from the outside between the animals, partitioning them off separately or in pairs, as may be desired. The bars are raised from between the animals to the roof before unloading, when they are driven out in the ordinary way, and the car is left in condition for returning freight.

The car will accommodate sixteen steers, giving each animal a separate stall. Hogs may be partitioned off in like manner, with from fifteen to eighteen in each pen, thus preventing them from piling upon each other and smothering. There is a tank underneath the car, with a capacity of ten barrels of water. This is connected with a pump on the roof of the car, by means of which the water is forced through a perforated tube, which extends through the entire length of the car, completely filling it with a fine spray, which, when continued for a few minutes, amounts to a shower bath. This is designed to allay thirst and internal heat by being inhaled, and to allay heat-fever and disease by keeping the pores of the skin open.

It is claimed by the inventor to be more consistent with the laws of health to keep the body thus refreshed than to allow it to take large draughts of water through the stomach while in transit, which often results in stiffening and foundering the animal.

It is claimed further that feed and water troughs may be attached to the car if found to be desirable at the conclusion of the experiments which are now being made. But the inventor is of the opinion that to deprive the animal from being taken from the cars and afforded a reasonable time for rest, at least as often as it is necessary to partake of food and water, is inhuman, and a violation of well settled physiological principles: an opinion which would have more weight were it possible to unload and reload the cars without hurting the animals more than a steady and unbroken journey would.

ANTI-VACCINATION FOLLY.

The coming of an English gentleman, with a craze against vaccination as a preventive of smallpox, has been made the occasion of an attempt to stir up opposition to the practices of our American physicians and boards of health in this connection. By parading a portentous array of figures to show that vaccination does not prevent smallpox and does entail a vast amount of disease through blood contamination, not a little feeling is aroused, especially among the ignorant; the anti-vaccination spirit prevailing in English and other European circles, embracing no inconsiderable body of the more intelligent classes, being urged as a reasonable ground for similar opposition here.

Those who have echoed the anti-vaccination cry, however, do not appear to be familiar with the circumstance that, owing to radically different methods of obtaining and using the vaccine virus here and in Europe, no argument based on European results can have any application here. The adverse statistics derived from European experience, or from American experience previous to the adoption by our physicians of correct methods and uncontaminated virus, may all be strictly true, and doubtless are substantially true; yet our confidence in proper vaccination need not be shaken in the least. Accordingly our European friends, instead of trying to propagate their notions here, would do much better to study the methods employed in this country and try them at home. Vaccine virus, not contaminated and stripped of its virtue by over-humanization—that is, by repeated transmission from man to man—is both free from risks and of certain efficacy. No better proof of this fact is required than the practical stamping out of smallpox in this great city. In view of the fact that by the general adoption of correct vaccination, smallpox, but lately one of the worst of human scourges, has been so thoroughly brought under subjection in this great city, that with 1,100,000 inhabitants there were last year but fourteen cases of the disease, it is manifestly as unwise as it is absurd for our newspapers to lend themselves to the propagation of anti-vaccination nonsense.

THE FUTURE WATER SUPPLY OF PHILADELPHIA.

Philadelphia is now supplied with water chiefly from the Schuylkill River, a part coming from the Delaware. The water is pumped to the levels required by steam pumps with high lifts. There are seven pumping stations: the Fairmount on the Schuylkill, the Schuylkill, the Spring Garden, the Delaware, the Belmont, the Roxborough, and the Frankford, with an aggregate capacity of about fifteen thousand million gallons a year.

The rapid growth of the city has resulted in the serious contamination of most of the sources of the city's water supply, making a resort to streams draining regions less thickly populated an urgent necessity. The latest project, that of Mr. James F. Smith, C.E., contemplates a gravity supply by aqueduct, to be drawn from the upper portion of the Perkiomen Creek and its tributaries. A short distance above the Green Lane station of the Perkiomen Railway, in Montgomery County, there is, Mr. Smith says in the *Journal of the Franklin Institute*, an admirable site for a dam, at a point where the stream cuts through a ridge of hard rock, making a gap of about 300 feet across, with precipitous sides. At this place the dam may be 90 to 100 feet high, backing the water several miles into a valley, with favorable slopes bounded by hills and ridges. From this point the proposed aqueduct runs southeasterly in a straight line about 27½

© 1879 SCIENTIFIC AMERICAN, INC

miles, to a receiving basin in Germantown, the surface of which might be 240 feet above the city datum, and the water surface nearly 249 feet above the city datum, or 254 feet above mean tide in the Delaware. In the first 10½ miles of its course the proposed aqueduct crosses a number of important tributaries to the Perkiomen, which rise in the hills dividing the waters of the Delaware from those of the Schuylkill in Montgomery and Bucks counties, more than 500 feet above tide. It is a part of the plan to make these streams tributary to the water supply by the erection of impounding dams upon them.

The area of the watershed of the Perkiomen above Green Lane, and the tributaries crossed by the aqueduct, is not less than 200 square miles, with a rainfall capable of affording about a hundred thousand million gallons a year.

The advantages of the proposed plan include the following: It will supply from a single point more water than is required for the present population of the city, and will deliver the water to a basin 27 feet above the highest reservoir in the city (Belmont), and from 104 to 145 feet above the other existing basins. It can supply Roxborough and Mount Airy basins by a pumping station at the aqueduct, near the former basin, and save more than 200 feet in the lift encountered at the present Roxborough pumping works. It will obviate the necessity for all the present steam pumping stations, with their expensive and often troublesome monster pumps, and leave Fairmount and its water power, when disconnected from the basins, to be run moderately in the summer to feed lakes and fountains in the park or in flushing main sewers.

The estimated cost of the work is less than that of the Croton Aqueduct; and as the full capacity of the aqueduct will not be required for many years, a large part of the work can be delayed until the city will be easily able to bear the burden.

EDISON'S ELECTRICAL GENERATOR.

BY CHARLES A. SEELEY, PH D.

Electric machines convert mechanical into electrical energy. The obtaining of electricity may be considered a manufacturing process, wherein steam power is the raw material and electricity the product. The best machine, other things being equal, will give the greatest yield of finished product from a given expenditure or consumption of raw material. The ratio of yield to consumption is the expression of the efficiency of the machine.

How many foot pounds of electricity can be got out of 100 foot pounds of mechanical energy? Certainly not more than 100; certainly less. What are the sources of loss, and what become of the lost foot pounds? Friction and resistance of the air inexorably demand their share in all kinds of machines. In the electric machine a heavy armature, sometimes spread out like a fanning mill, must be revolved at the rate of 500 to 1,000 times in a minute. Also there are great leakages incidental and peculiar to the electric machine, which may be summed up in the expression local actions, which consist in currents induced outside of the normal circuit, changes in the magnetism of the magnet cores, etc. How many foot pounds do we lose or are we obliged to lose out of the 100 expended? How many foot pounds of electricity are left after deducting the losses? The facts and laws of physics, with the assistance of mathematical logic, never fail to furnish precious answers to such questions. People generally, however, are not familiar with the methods and language of exact science, and prefer results of direct, plain, actual, and practical experiments, results unmixed with any abstraction. We appeal now to the testimony of such experiments.

In 1877 a committee of the Franklin Institute, consisting of ten competent and eminent experts, with a view of determining the capabilities of electrical generators, made a series of trials with the best machines then procurable. Their elaborate report describing the details of experiments was published in the May and June numbers of the Institute *Journal* of 1878. This report has become a recognized authority, and remains, so far as I know, in all respects unimpeached; and I shall use it now with fullest confidence in the accuracy of its statements. The committee experimented with 6 machines: 3 Brush, 2 Wallace, 1 Gramme. To suit my present purpose I have reduced statements of the report to the simple symmetrical form of the table below. This table shows the losses and produce of 100 foot pounds of power delivered upon each machine; the figures may be read as representing foot pounds or per cents.

1.	2	3	4	5	6
a. Brush	16·7	33 5	50 1	50·	31·
b. "	10·4	50 9	61·1	39·	22·
c. "	11·1	41·	52·1	47·	27·
d. Wallace	8·	53·2	58·2	38·1	14·
e. "	8 6	63	71·6	30·3	12·
f. Gramme	7 4	21·	28·4	71·2	38·

1. Names of machines.
2. Friction and resistance of the air.
3. Local actions, including all losses, except those of 2.
4. Total losses, the sum of 2 and 3.
5. Total current of the normal circuit, or the total yield of electricity.
6. The electricity utilized in producing light. It is substantially the amount utilizable for any purpose.

I present this table as worthy of thoughtful attention; it should interest all electricians. The facts which a little study will disclose may prove somewhat appalling to those whose imaginations have been busy with bringing Niagara power to New York and with the demolition of gas companies.

The facts shown in columns 5 and 6 are worthy of special attention. The total produce of electricity is shown in 5, and in 6 the practical value of that electricity; the figures in 6 are only about one-half the corresponding figures of 5. Why is it that when we have produced the electricity half of it must slip away? Some persons will be content if they are told simply that it is a way which electricity has of behaving. But there is a satisfactory, rationa. explanation, which, I believe, can be made plain to persons of ordinary intelligence. It ought to be known to all those who are making or using machines. I am grieved to observe that many persons who talk and write glibly about electricity do not understand it; some even ignore or deny the fact to be explained. I will try to set forth the case plainly.

Electricity moves in a circuit, and in moving disappears; that is, it is converted into some other form of energy. The same electricity does not move round and round again; it never repasses the starting point; it does not exist to repass the starting point. As it moves it falls and dies in its tracks, and its dead body at once and on the spot is resurrected, but in a changed form. Now a part of the circuit is always and of necessity inside of the machine or battery; it is the wire of the armature or the liquids and the metals of the battery. This part of the circuit also is inaccessible, and the electricity which is here transformed is unavailable; this electricity, in fact, is worse than useless, for the heat into which it is transformed is one of the serious practical difficulties of the machine. It is then only the electricity which appears in the circuit outside of the machine which is utilizable.

At this point plausibly comes in a suggestion that the internal part of the circuit be made very small and the external part very large. Why not (say) make the internal part 1 and the external 9, thus saving $\frac{9}{10}$ and losing only $\frac{1}{10}$? Unfortunately the suggestion is not practical; a fallacy is concealed in it.

The electricity is truly converted throughout the entire circuit, but not evenly in proportion to the length of the circuit. The conversion takes place precisely and exactly in accord with the resistance in the circuit to the flow of the electricity. The electricity may be considered as distributed over the whole circuit *pari passu* with the resistance, and thereupon is transformed into energy of another name, distributed as to the quantity precisely as was the electricity. This explanation does not disclose the weakness of the suggestion, but it will assist us in finding it.

Beasts of burden and other rational creatures redouble their efforts when their burdens are increased, and "thrice is he armed," etc. Electricity behaves very differently; there are no moral suasions or reserved forces behind it. Increase its burden, and it weakens right down; it is more stubborn than a mule; it won't budge at all, except after its narrow plan. The law of the electric current is that it exists or is produced *inversely* as the resistance to its flow in the circuit; double the resistance and the current is halved; treble the resistance and the current is one-third, etc. In any machine let the armature revolve steadily, and the current produced will depend solely upon the resistance; with the least resistance you get the maximum current, with the greatest resistance you have the minimum current. Now, also, the internal resistance of any machine is constant or unalterable. In order to get any external effect, external resistance must be added to the internal. To get the greatest yield from a machine or battery, it must be short circuited; that is, the external resistance must be suppressed; but then you find yourself in the interesting predicament that all the electricity is securely bottled up in the armature and is of no good to you. On the other hand, arrange things so that the greatest part of the resistance is external, and the electricity has shriveled up to a quantity which is utterly useless to any allopath. There is evidently a just mean; what is it? What is the best practical ratio of the external and internal resistance? The mathematical calculations which clearly and beautifully answer this question, and which take in the principle that the sum of variables is least when they are equal, are probably beyond the experience of the average reader, and I substitute a sort of cut and try method.

Let the current of the short circuited machine be (say) 100. Now add an external resistance (R″) equal to the internal (r), thereby making a doubled total resistance (R). ($r + R' = R$). The total current has become 50, and the external or utilizable part of it is 25. Treble the R, making $r = 1$ and $R' = 2$, and the total current becomes $33\frac{1}{3}$ and the utilizable part 22·2. For another trial, make external half as great as internal $r = 1$, and $R' = \frac{1}{2}$, and total current becomes 66·6, of which 22·2 is utilizable. Now we are getting indications of the fact that the greatest external current is produced *in a given time* when the external and internal resistances are equal. I recommend the reader who is not yet satisfied to continue the cut and try plan till he shall be.

But, exclaims the bright scholar who is always on the *qui vive* for flaws, it is a question of economy, and it may be best to take a little more than the given time, and so get a greater portion than the half for our use; time is cheaper than coal; or, if we must have a certain great quantity of electricity in a short time, we may build a very big machine or use a good many little ones; why not save nine-tenths of the total current? The remarks of the bright scholar are always entertaining, sometimes they are instructive. The trouble with him is that although his vision is very clear it is not so wide; he is quick to spy out a thing, but he does not observe its environments. Why not nine-tenths? It is a hard thing to do after perusing the table of results above given; but consider or imagine that the losses of a machine by friction and local action are reduced to one-tenth, so that 100 foot pounds of steam power produce 90 foot pounds of current, of which the external part of the circuit (= to the internal) shall have 45. Now adjust external resistance so that you shall get $\frac{9}{10}$ outside and $\frac{1}{10}$ inside, and weigh and figure up the results. Instead of getting 9 for 10 invested, you have 16·2 avails of 28 invested, or at the rate of 5·8 from 10 invested. There is a clear gain by attending to the spigot, but the steady leakage at the bung was still going on. I do not mean to say that the equalizing r and R′ should be an inflexible practical rule, but simply that the advantages of varying from it are not so great as some persons suppose; also the loss from local action is not constant for varying products of electricity; the illustration ought not to mislead any one, and the precise data for determining the peculiar ratio of r to R′ for the most economical working are plainly enough indicated.

Now, on looking over the above I feel as if I had led the reader over a wearisome roundabout road, when there is a short cut across lots to the destination. My excuse is that the short cut is not a familiar thoroughfare, and the average traveler cannot feel confidence in it. Mathematics is what I have in mind. To the mathematician the expression $a^2+b^2=c^2$ is the clear expression of the relation of the sides of right-angled triangles and many other things, but we plain people whittle up a great many shingles or pencils in the cut and try plan before we can apprehend the thing it teaches.

But there is one little expression, simple in form, yet full of meaning, in fact a mine of the elements of ideas on electricity, which I would, if I had my way about it, compel the reader to wrestle with till he had completely mastered it. It is the expression of the principal facts about the electric circuit; it is called Ohm's law, and it is this: $C=\frac{E}{R}$. C is the strength of the current, that is, the quantity (say ft. lb.) flowing per second. E is electromotive force, an idea corresponding to tension, pressure, or head. R is resistance to the flow. (It will assist the tyro to observe that electricity has some of the properties of ordinary fluids, and that Ohm's law is true for water and steam. Let, for example, C be galls. of water per minute, E head of water, R resistance to flow, narrowness of pipes, friction, etc. The formula, however, is not useful outside of electricity, mainly for the reason of the difficulty of specifying and keeping constant the elements which constitute R.) The formula declares that C varies directly with E, and inversely with R. In any machine E varies with velocity; when the velocity is uniform E is constant, whatever be the ratio of external and internal resistance, or whatever be the produce of the machine in usable current. If it is desired to distinguish the internal (r) from the external (R′) resistance, $r+R'$ may be substituted for R, when $C=\frac{E}{r+R'}$. In any machine r is always constant, and E is constant for constant velocity; in this last case C can vary only with R′. C represents only the total C of the normal circuit; the useful C, or that which can appear as light, heat, chemical or mechanical energy outside of the machine, $=\frac{C(r+R')}{R}$ etc., etc.

But about Edison's electric generator! The articles about it on pages 242 and 272 are the texts on which I have discoursed, and although I have not named the generator, it has all the time been in mind. Those who are accustomed to read between the lines, have some of my thoughts which are not yet put on paper. But lest any one should suppose that I am unfriendly to Mr. Edison and his work, I hasten to say that I am fully in accord and sympathy with the writer of page 242, when he asserts and laments that the newspaper reports of the sayings and doings of Mr. Edison were exaggerated and inaccurate, and consequently damaging to him. No one capable of making the improvements in the telegraph and telephone, for which we are indebted to Mr. Edison, could be other than an accomplished electrician. His reputation as a scientist, indeed, is smirched by the newspaper exaggerations, and no doubt he will be more careful in future. But there is a danger nearer home, indeed among his own friends, and in his very household. The lamentable case of Deacon Richard Smith and his wicked partners should serve as a warning. It is said that the Deacon was wise and good until his wicked partners got control of him, when he behaved foolishly and uttered blank nonsense. The writer of page 242 is probably a friend of Mr. Edison, but possibly, alas! a wicked partner. Why does he say such things as these: "Mr. Edison claims that he realizes 90 per cent of the power applied to this machine in external work;" "The economy of this machine is shown by the fact that one man may turn it with sufficient rapidity to maintain the electric arc of a Jablochkoff candle, etc." Perhaps the writer is a humorist, and had in his mind Col. Sellers, Indian trader foot pounds, etc., which he could not keep out of a serious discussion; but such jests are not good.

Mr. Edison has built a very interesting machine, and he has the opportunity of making a valuable contribution to the electrical arts by furnishing authentic accounts of its capabilities.

New York, October 30, 1879.

EVERY person who has money to invest always desires to place it where it will produce the best returns. This incontrovertible fact being admitted, we undertake to say that $3.20 invested in one year's subscription to this paper will bring a larger return to the manufacturer, machinist, inventor, farmer, or lover of physical science, than the same amount invested in any other way. A year's numbers makes a volume of over 800 pages, costing only $3.20.

© 1879 SCIENTIFIC AMERICAN, INC

BLAKE'S SECTIONAL CUSHIONED CRUSHER.

The accompanying engravings illustrate a very important improvement recently made in stone breakers by the Blake Crusher Company, of New Haven, Conn., original patentees and manufacturers of the machine of world-wide reputation, known as Blake's patent stone and ore breaker.

One of these new breakers is now daily in operation at the American Institute Fair, New York city. A careful examination of its merits, as compared with the old forms of the machine, will repay all those who are interested in the rapid and economical reduction of masses of stone to small fragments, either for road material, railway ballast, concrete, or of metalliferous ores, preparatory to further reduction for the extraction of the metals. In the new machine, called the "Challenge Rock Breaker," the heavy solid cast iron frame of their old forms of crusher is dispensed with, and the main tensile strains, due to the crushing between its powerful jaws, are brought upon wrought iron or steel instead of cast iron.

The construction of the machine is well shown in the engravings, and its operation will be readily understood. A three-sided framework of cast iron, with broad flanged base, holding the movable jaw in suspension, forms the front part of the machine, between the upright convergent jaws of which the stone is crushed.

The jaw shaft is held in place by wrought iron or steel clamps, C, which serve to take part of the strain due to crushing in the upper part of the jaw space, and also serve as walls thereof. In the lower part of the three-sided frame or front part of the crusher, and on each side of it, are holes in the casting to receive the main tension rods which connect the front and rear parts of the machine. The rear part, B, is called the main toggle block, and is also provided with holes for the tension rods, R R, corresponding to those in the front casting.

These two parts of the machine are connected by the main steel tension rods, R R, each provided with screw thread and nuts, by which their lengths and the jaw opening are readily adjusted to crush coarse or fine, as may be desired.

The front and rear castings are supported on parallel timbers, to the underside of which are bolted the boxes carrying the main eccentric shaft, provided with fly wheels and pulley. The timbers are thus made component parts of the machine, and take the transverse strain which comes upon the pitman connecting the main shaft and the toggle joint placed in the rear of the movable jaw, and between it and the main toggle block.

Between the broad flanged bases of the front and rear castings and the timbers on which they rest, are placed flat rubber cushions one quarter to three eighths of an inch thick. Every revolution of the shaft brings the toggles more nearly into line, and throws the swing jaw forward; it is withdrawn by the rod provided with rubber spring, L. In this way a short reciprocating or vibratory movement is communicated to the movable jaw.

It is evident that this new construction of the Blake stone crusher—while the principle of crushing between upright convergent jaws is the same as in their old machine—possesses many and great advantages over the old forms. It is sectional. The weight of the heaviest piece in crusher size 15x9 inches is about 2,400 pounds instead of nearly 8,000. The rigidity inseparable from machines with cast iron frames, and which is the cause of frequent breakages, is completely overcome, and the longitudinal as well as transverse strains are brought upon materials which are strong and elastic as compared with cast iron. The rubber cushions, while offering sufficiently great resistance to compression in case of the breakage of stone or in doing the normal work of the machine, will, in case of the accidental intrusion of steel hammers or anything of that kind, be compressed and so permit the partial revolution of the flywheels before coming to a full stop, thus relieving the machine of those nearly infinite strains to which those of the old form were subjected, and which resulted in breakage of important parts. The toggles are long, and of equal length, and may be worn indefinitely as compared with those in the old machine. The construction of the pitman is such as to admit of change of inclination of the toggles, and consequently of adjustment of the length of stroke of the movable jaw. The jaw opening can be varied between any working limits by means of the nuts on the tension rods, and the machine be set to crush coarse or fine as may be desired. The crusher, it is stated, can be run at a higher rate of speed with safety than either of the old forms of crusher with cast iron frames, and will consequently do a greater amount of work. The manufacturers inform us that while this machine is very much lighter than the old forms, it has at least double their strength.

The new challenge rock breaker has been repeatedly subjected to the test of a steel hammer being thrown between its jaws, when going at as high a rate of speed as 300 revolutions per minute, without injury to or breakage of the machine. The machine is the invention of Mr. Theodore A. Blake, mining engineer, and Secretary of the Blake Crusher Co., New Haven, Conn. Patents covering main features of the machines have been allowed and will shortly issue.

We understand that several cities are replacing old forms of crusher with the new, among which are New Haven, Conn., Providence and Newport, R. I., and Holyoke, Mass.

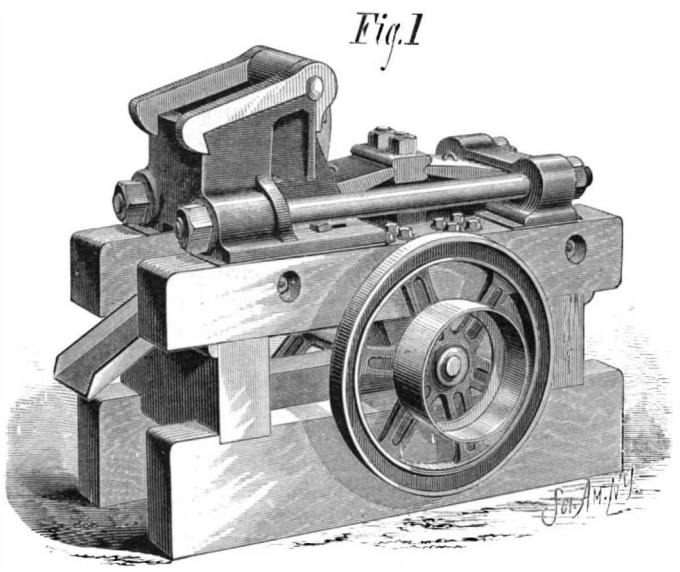


Fig. 1

BLAKE'S CHALLENGE ROCK BREAKER, OR SECTIONAL CUSHIONED CRUSHER.

MISCELLANEOUS INVENTIONS.

Mr. Thomas L. Rankin, of room 75, Astor House, New York, has recently secured several United States patents for improvements in ice making apparatus. We are informed that during recent trials of the apparatus, in this city, very satisfactory results were obtained. The apparatus, while it is capable of making ice economically, is intended more especially for direct refrigeration, and is especially adapted to the refrigeration of vessels, beer vaults, and cooling rooms of slaughter houses. It will be remembered that not long since Mr. Rankin produced a sheet of artificial ice covering the entire area of Gilmore's Garden in this city, the largest artificial sheet of ice ever made. One of the novel inventions of Mr. Rankin is a cover for soda water fountains, which is shaped like icebergs and refrigerated to produce a coating of ice on their outer surfaces.

An improved self-adjusting relay has been patented by Peter S. Bates, of Bloomsburg, Pa. The object of this invention is to furnish relay instruments which shall be so constructed that the current passing through it will govern the spring of the armature and cause it to adjust itself to the force of the current, whether the current be very strong or the weakest current that will pass over the line, rendering it unnecessary for the operator to touch the instrument.

Mr. Christopher C. Hackett, of Floyd, West Carroll Parish, La., has patented an improvement in digging and curbing wells which insures accuracy in the shape of the well and the direction of the digging; it also enables the two operations of digging and curbing to be proceeded with simultaneously, and protects the workman from falling bricks and the caving in of the well.

Mr. Nicholas C. N. Laurense, of Detroit, Mich., has invented an improvement in methods of mounting chromos, engravings, pictures, and the like, consisting of pasting a sheet of paper over the back of the chromo or picture, covering the outer surface of the paper with a paste or composition that will quickly set, and then pasting or gluing narrow strips of cloth on the back of the picture near the edges, and pasting or gluing them to the sides of the stretcher.

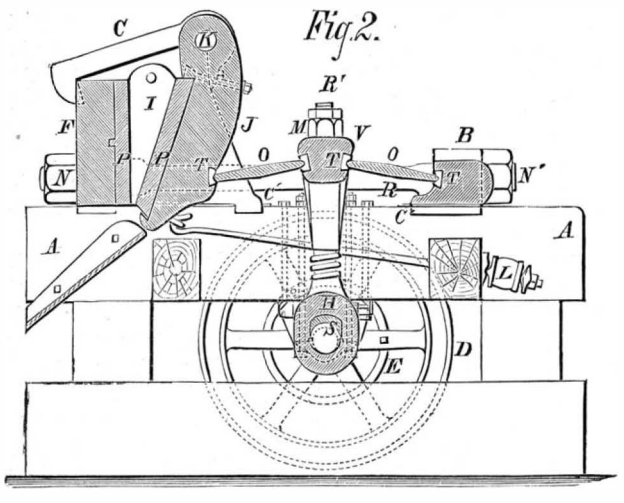


Fig. 2.

LONGITUDINAL SECTION OF BLAKE'S CRUSHER.

Messrs. Melvin A. Belcher and George F. Perrenot, of Rockport, Texas, have patented a manacle or shackle for the hands and feet, that will offer effectual resistance to any attempt to break them while on the hands or feet, and that will, when on the hands, prevent one from using any instrument for effecting his escape.

An improved stovepipe receiver has been patented by Mr. William Shaw, of Millbridge, Maine. The object of the invention is to enable a stove to be set up to any height of flue within the limit of the height of the room, and also to provide an arrangement to be used in connection with any stovepipe hole that will admit of any sized pipe (of the sizes usually made by stove makers) being joined to the hole without trouble or inaccuracy.

Mr. Reinhold P. H. Koska, of East Saginaw, Mich., has patented a device for holding eggs while opening them. The invention consists of a pair of tongs, whose legs terminate in concavo-convex plates, that when closed together shall be in shape like an egg, with its upper third removed, so that when they are brought together they may embrace and cover the lower two-thirds of the egg.

Messrs. Henry W. Wilson and Alonzo Gandy, of Freeport, O., have patented an improved thill-coupling, which will allow the thills to be readily attached and detached, and which will prevent any noise or rattling when in use.

Mr. William R. Kitchen, of Willard, Ky., has patented an easily operated device for detaching the harness tugs from the ends of whiffletrees, and it consists of a ferrule with projecting arms, in which is pivoted a crossbar with a pin which enters a hole in a lever pivoted below. The tug is released by moving the lever.

An improved apparatus for coating pills has been patented by Mr. Henry M. Dury, of Edgefield, Tenn. The object of the invention is to facilitate the operation of coating pills with gelatine and other fluid coating materials. It consists of a shallow circular dish or pan, in the bottom whereof are hemispherical indentations to receive the pills. In this pan works a plunger provided with projecting needles or points corresponding in number to the indentations. Sheathed over these needles or points there is a metal plate attached to a rod passing up through the handle, and held up so as leave the needles unsheathed by a spring, the apparatus being adapted to take up the pills from the pan and hold them while they are being dipped into the coating material and until they dry, after which they are forced from the needles by pressing the metal plate against them.

Mr. Johannes Schuhmacher, of Roemische Posel, Soernewitz bei Meissen, Koenigr Sachsen, Germany, has patented an improved process of producing collodion transfer pictures upon linen or other material, which consists in first washing with a solution of gelatine the surface that is to receive the picture, then flowing it with the collodion mixture described, and printing thereon from the negative, then finishing in the usual manner, then coloring and applying adhesive varnish, and then transferring the collodion picture film.

The Polyphemus.

The Polyphemus, now being completed for commission at Chatham, England, promises to be a complete novelty among offensive ironclads. She is to be built entirely of steel, and her deck is to be covered over with three inch plating of a convex shape. This convex curvature is continued round her sides some distance below the water line, after which her sides converge towards her keel, or rather to where her keel should be in a V shape. Her midship section will thus appear the shape of a kite, the convex deck only rising 4 feet 6 inches above her water line. She is 240 feet between perpendiculars, the extreme breadth is 40 feet, and she will have a load draught of 20 feet. The engines are estimated to work up to 5,500 horse power, and to give her a speed of 17 knots. What a dangerous enemy she will prove is evident from her speed alone, as her principal means of offense are a ram or steel spur and Whitehead torpedoes. Her form of construction is evidently intended to enable her to escape notice, and even when observed, to escape damage by the deflection of shot rather than by absolute resistance to such impact. There is much of interest and importance in this experiment, for such indeed it is, the vessel being constructed after the idea of Sir George Sartorius, a well known veteran of the navy. We consider the Polyphemus as one of the first attempts in construction to foil the impact of heavy shot by diversion rather than by the probably futile resistance of a heavy armor plating. Another important modification has been made in her construction to enable her to benefit to the full extent by the principle of subdivision into water-tight compartments, which is particularly carried out in her design, and on which she must very largely rely for safety. The modification is that an enormous mass of cast iron ballast is carried outside the vessel in a rectangular groove 1 foot 8 inches wide, and 3 feet deep, situated where her keel should be. This mass of ballast amounts to 300 tons; her total displacement being 2,640 tons, and represents in weight a volume of rather more than ten thousand cubic feet. This ballast is so arranged that it can be released from the vessel at will, so that should one or more of her water-tight compartments be pierced, the loose ballast may be dropped from the part of the vessel corresponding to the flooded compartment. The position or power of flotation may thus be retained undisturbed, even after several compartments may have been pierced. She carries no masts, except for signal purposes, and her guns are a few light shell and Gatling guns on her upper deck.—*Marine Engineer.*

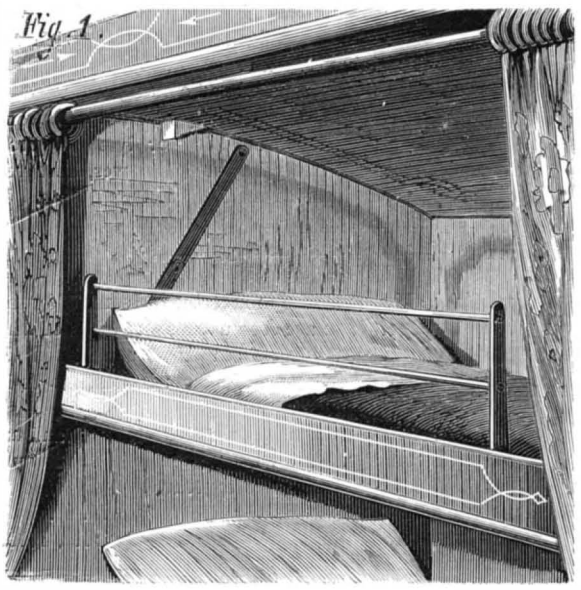
An Octoplex Printing Telegraph.

Prof. Klinkerfues, the director of the Göttingen Observatory, has, it is said, taken out a patent for a new invention in telegraphy. The professor has discovered a method by which up to eight different messages may be sent simultaneously by the same wire, an apparatus at the receiving end printing the messages separately and all at the same time.

© 1879 SCIENTIFIC AMERICAN, INC

IMPROVED SLEEPING-CAR BERTH.

The annexed engravings represent a novel guard for sleeping-car berths, recently patented by Mr. Frederick C. Hills, of Missouri Valley, Iowa. It is intended to prevent sleepers from rolling out of the upper berths of cars and vessels, and to prevent car berths from closing up and shutting the occupant in, in case of accidents. Fig. 1 is a perspective view of a berth ready for occupancy, and Fig. 2 is a transverse section, showing the bed in different positions. The berth, A, is hinged in the usual way, and supported at each end by a jointed and pivoted link, B, which permits of closing it when the berth is not in use. To the front of the berth is



HILLS' SLEEPING-CAR BERTH.

pivoted a guard, C, formed of horizontal rails and end pieces. This guard, when the berth is occupied, is turned into an upright position, but when the berth is not used the guard is folded down and the berth thrown up into the pocket in the usual way. In case of an accident, when a berth is occupied and the guard is up, the upper ends of the end pieces of the guard abut against the stops or lugs fixed in the berth pocket, thus preventing the closing of the berth and protecting the sleeper. This invention will be appreciated by those who are often upon the road and are frequently obliged to occupy an upper berth.

NEW PERSPECTIVE DRAWING APPARATUS.

While the artist can, in an off-hand way, sketch a perspective which will appear perfect to the eye, and which, in the majority of cases, will be found nearly if not quite perfect, it is only the artist dealing with an artistic subject that can do this. The draughtsman who is required to make all kinds of drawings, not only quickly but accurately, often finds it an exceedingly difficult matter to make a perspective drawing without some kind of mechanical aid.

The instrument shown in the accompanying engraving is intended for drawing perspectives easily and accurately. It is the invention of Mr. George Rosquist, Brooklyn, N.Y.

The drawing table is pivoted to a standard so that it may be inclined at different angles, and it is provided with an adjustable bar that supports one arm of an ordinary pantograph. The lower half of the table, which is wood, is designed to receive the paper on which the drawing is made. The upper half of the table is of transparent glass, and a perforated sight piece is supported by a right angled arm directly in front of the middle of the glass. The tracing point may be moved along the surface of the glass, and the pencil moves in the same way over the paper on the lower part of the table.

The object to be sketched is placed a suitable distance from the instrument, and the eye is placed at the aperture of the sight piece; the outline of the object is followed by the tracing point of the pantograph, the glass affording a guide for the point and keeping the pantograph in a true plane. As the tracing point is moved the pencil carried by the pantograph over the paper traces the outline of the object, either larger or smaller than it appears through the sight piece. After the sketch is finished the drawing table may be turned down into a horizontal position, when the sketch may be inked in the usual way.

Steam Fire Engine Improvements.

Mr. Blinn Converse, of St. James, Minn., a locomotive engineer on the St. Paul and Sioux City Railroad, has invented and patented an apparatus for the purpose of generating steam with great rapidity. It consists of a circular exhaust fan, which is caused to revolve with immense speed by clockwork. The fan is placed in the upper portion of the smoke stack, and it thus causes, when in motion, an immense and powerful current of air to be drawn through the fire below. And therein lies the whole secret of its success, which was amply proved. The boiler of the engine, to which the apparatus was attached, having been filled with cold water, and the fan having been set in motion and the fire lit, the following was the result: The steam gauge started to move in three quarters of a minute; in one minute two pounds of steam were generated; in one and a half, eighteen pounds; in three and a half, thirty-nine pounds; and in four minutes, forty pounds. Almost at the first revolution of the fan, the flames were drawn clear out of the stack. Under ordinary circumstances it would take about ten minutes to raise the last steam pressure above given from cold water.

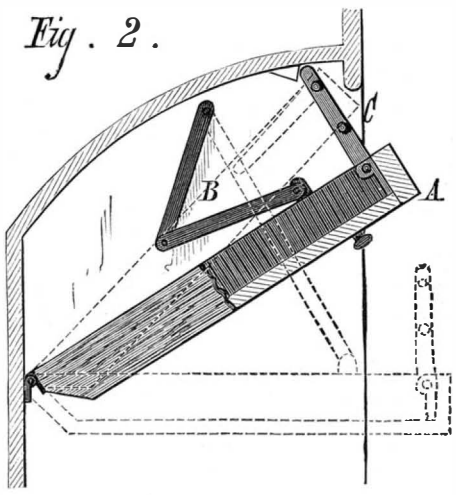
During a recent trial of a new steamer at Milwaukee, of the Ahrens make, in four and a half minutes after lighting the fire, water cold, the steamer was throwing water 100 feet, and in ten minutes 293 feet. A vertical 1⅜ stream was maintained to a height of 240 feet.

The Philosophy of Physical Science.

Professor Trowbridge, of Harvard University, in a recent lecture before the Lowell Institute, prefaced his remarks by giving a list of books on topics touched upon in the lecture of that evening. The Boston *Daily Advertiser*, from whom we quote, says: They were: Mill's "System of Logic," Jevons' "Principles of Science," Herbert Spencer's "First Principles of Philosophy," Huxley's "Physical Conditions of Science," and Professor Wundt's "Open Letter on Spiritualism." To use the words of Lord Bacon, said the lecturer, some of these were to be tasted and others swallowed. Physics was a term recently substituted for natural philosophy, as being more comprehensive. The most complete definition of physics would be that it meant motion in contradistinction to rest. There was no such thing as rest, in a scientific man's mind. So considered, physics was the noblest of sciences. There was no such thing as rest, in a physical sense. Motion was a word that called up a definite impression to us all. Motion was both seen and unseen, and vibrations sensible to the ear were insensible to the eye. This was illustrated by rubbing a bar, the friction causing a sharp tone and generating power enough to set a ball in motion. Sound, electricity, and magnetism were also forms of motion.

Professor Trowbridge then spoke of the laws of physics, and said he would not discuss the relations between physics and physiology. He would endeavor to promote scientific thinking. Definite thinking on one subject led naturally to definite thinking on another subject. In speaking of the philosophy of physics, he said that every man and woman philosophized in some way and to some extent. The philosophy of physics entered upon all subjects. It was the investigation of the physical laws of the universe, and was the result of the investigation of the truth by means of evidence. It was based upon the laws of causation. There were unthinkable regions into which it could not enter. Metaphysics were contrasted to scientific methods of thought, which left off diving into the unfathomable. Conclusions were reached by processes of induction and of deduction. The former process was that followed by the lawyer. The more nearly a science approached a deductive form the more nearly perfect did it become. The science of electricity was rapidly changing from an inductive to a deductive science. By the possession of good means of deduction a man might be saved half a lifetime spent in experimenting. It would not do to rely upon the old adage, "Seeing is believing," for in reality seeing was not believing.

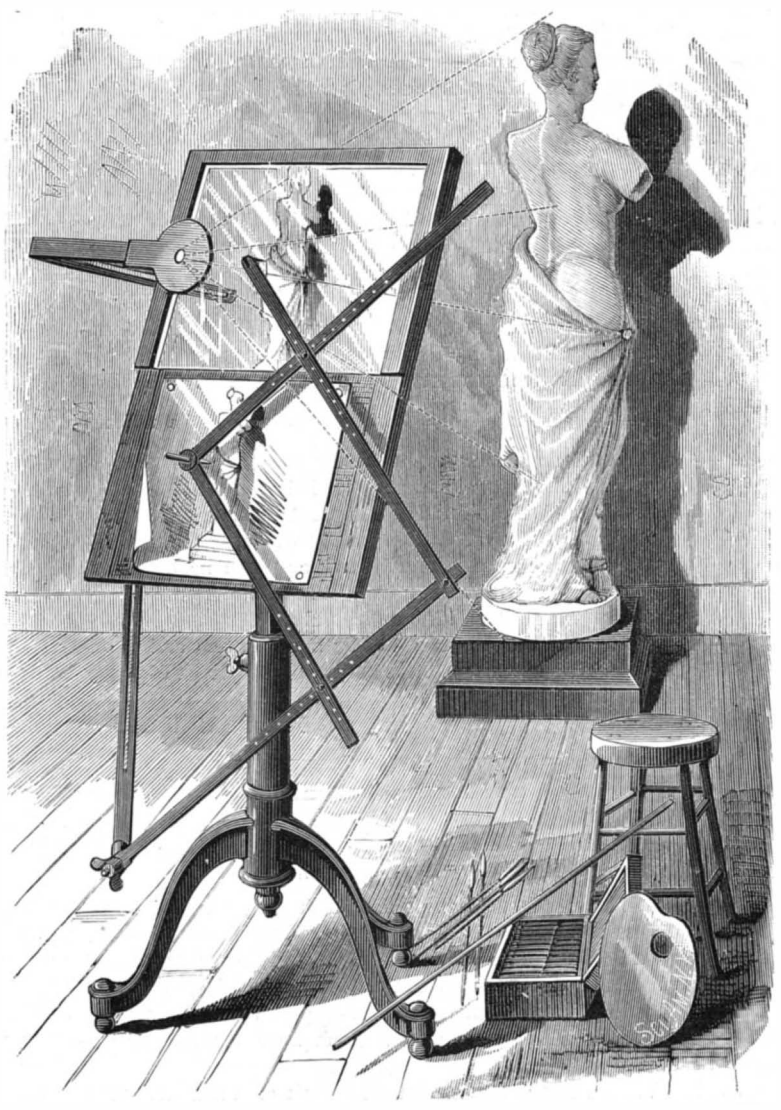
The importance of unknown factors was to be taken into account in all investigation. The able man would abandon a theory, but the ignorant man would not, and the latter imagined that the scientist held to his theories in the same blind way that he himself did. There was a strong undercurrent of credulity and superstition running through all classes of society, even the highest. There were three classes of thinkers—persons who could only think from A to B, those who could think back again from B to A, and the rarer



TRANSVERSE SECTION OF SLEEPING-CAR BERTH.

class who could think both these ways, and, so to speak, at right angles to them.

Professor Trowbridge then spoke of various forms of delusions into which people led themselves and were led by following unscientific methods of thought. It was possible for a man to construct a motor so that by means of minute concealed clockwork—under the table, for instance—it would run for a considerable time and appear to gain its power from permanent magnets. By restricting investigation to the motor when placed in four or five different positions only, places where the secret mechanism was concealed, persons were made to believe in the most wonderful things. Thus had many impostors with motors, clairvoyance, etc., obtained credence. In closing, Professor Trowbridge illustrated the ideas of infinite magnitude and infinite minuteness by contrasting the extent of the universe with the quadrillion molecules held in a sealed glass tube.



ROSQUIST'S PERSPECTIVE DRAWING APPARATUS.

MECHANICAL INVENTIONS.

Mr. Daniel M. Holmes, of Arlington, N. J., has invented an improvement in cake machines, for which letters patent Nos. 174,244 and 188,366 were granted February 29, 1876, and March 13, 1877, respectively, to the same inventor. The invention consists in the combination of tubular cutters and conical flanged heads with the bottom of the discharge compartment of the dough box. Mr. Holmes has also patented other improvements intended to facilitate the discharge of the cakes from the cutters.

An improved fish scrap elevator, patented by Mr. Samuel P. Hedges, of Greenport, N.Y., which consists, essentially, of an upright frame supported on wheels, and carrying a bucket elevator, to which motion is imparted by the action of the driving wheels, by which the fish scrap, etc., is removed from the drying platform, and elevated and delivered into an elevated hopper fixed on the back of the machine. The hopper is provided with a device to gauge and cut off at any time from the superincumbent mass a quantity of the material sufficient for a cartload.

Mr. Charles D. Judd, of Bridgeport, Conn., has patented an improved machine for tapping water and gas mains, by means of which the main may be drilled and tapped and the valve inserted without allowing the gas or water to escape.

Mr. James F. Wise, of Wadley, Ga., has invented an improved sand band for the inner end of the hub of a vehicle for protecting the collar, axle arm, and box from sand and dirt, which are liable to get in between these parts and wear them. It consists in combining a sand band having a right angular shank with a shouldered or recessed axle and a clip in such a manner that the sand band shall be firmly held between the shoulder on the axle and the collar of the axle journal, and the joint formed between the axle and the sand band shank shall be covered and concealed by the clip which secures he latter.

© 1879 SCIENTIFIC AMERICAN, INC

High and Low Grinding—New Process Flour.

The difference between high and low milling is exactly this. In low milling the reduction of wheat to flour is effected in a single grinding, the aim being to produce as much flour and as little middlings as possible. The speed of the running stone is considerably faster in the old process than it is in the new. If the stones are in proper dress, evenly balanced and adjusted, a large proportion of bran and gluten coats may be obtained without disintegration, but it is very often the case, particularly where a proper adjustment is not had, that a large amount of bran is ground with the flour. This passes through the bolts, and the result is dark flour. High milling is the opposite of low milling, the grain being reduced step by step. Starting with the pointed kernels, we have with each grinding three products. First, we have coarse fragments, with much bran attached; then less coarse fragments, with less bran attached; and finally, minute fragments, with little or no bran attached. These are separated from each other by purifying machines. Each of these products is again subject to grinding, and again sorted into grades, and so on until the last traces of the white interior of the berry have been separated from the dark hull and graded.

Although not by any means a new process, its introduction into this country is so recent that it is new to us, and therefore the term "new process" is not a misnomer. This process has been in use in Austro-Hungary for seventy years and upward, and a similar method was known in France thirty years ago. Even in the State of New York the purification of middlings has been known as far back as 1852. In 1850, John Laumeister, a German miller, built a machine for cleaning middlings or farina at Janesville, N. Y., and put it in successful operation. A perforated sheepskin was used as a sieve, and a current of air forced through the farina as it lay on the sieve carried off all the light stuff. In 1852 the proprietors commenced grinding the farina into flour, and from that time to 1864 it was used and sold as substantially what is now known as "new process flour." It is claimed for the new process that there are sixteen more pounds of flour produced from the quantity of wheat formerly used in producing a barrel, and that the flour is of a vastly superior quality. Another advantage claimed is that it makes a superior flour from spring wheat, which heretofore produced an inferior flour, and by this feature alone has made an important commercial change in different sections of the country as wheat bearing regions. Under the old process of making flour the winter wheat furnished by all odds the best article. This was obtained only in its best condition from the northern tier of the Southern States, or the extreme southern parts of the Northern States. Virginia, Kentucky, and Missouri furnished the bulk of the wheat making the best flour, and it commanded a higher price in the market than the flour of the Northwest. Now, by this new process, spring wheat makes a better flour than can be made with the winter, and commands a higher price in the market than the heretofore best kind from winter wheat. This lifts the Northwestern or spring wheat growing States to the front rank as flour producing States, and adds correspondingly to the value of all the property in them.

It is easy to account for the reason that high milling chooses Minnesota as its favored seat. The wheat in that State was mostly hard, flinty spring wheat, which made an inferior flour. In 1871, a Frenchman by the name of La Croix, a miller, happened to be in Minnesota, and introduced a machine previously known in France by the name of the Perrigault machine, which was a success from the beginning. Thinking there might be a still better machine, one was found in France, known as the "Sasseur Mécanique," invented by a M. Cabancs. As under the old process it was important to get as little middlings as possible, so under the new process the wheat is ground coarser, or, as it is technically called, "higher," in order to get as much middlings as possible. The slower grinding necessitates more stones, while the cleansing process calls for an addition of bolting capacity, which, with the purifier, embraces all the additional machinery required. No additional power is required, as a diminution in the speed of the stones gives all the power necessary for the extra stones. Granulation being the great principle of the new process, we must naturally look to the wheat grain for the facts which render granulation possible. The constituents of the wheat grain are in the form of granules or cells. Inside of the bran are the gluten cells, which contain the most nutritious constituents of the berry, and next beyond the starch granules. The principle in this system of grinding is to separate the granules from the cells with as little flour as possible, and then purify them with a blast of air by blowing away all the fine particles of flour. Under this system the cells are not destroyed, but simply disintegrated, and are supposed to maintain their individual forms the same as when locked up in the berry. This, to the advocate of new process milling, is the *Ultima Thule* of the art; but the writer cannot understand how a single granule can possess any more virtue in itself than if it was ground up with the gluten in the old way, or when it was an integral atom of the wheat berry.

At the present writing both processes have their advocates. Some claim that new process flour, while looking white and nutritious, must necessarily lack in good bread-making qualities. Our chemists tell us that immediately within the bran is the most important constituent, as it contains phosphates and nitrogenous ingredients, out of which the digesting and assimilating apparatus elaborate all the important tissues and organs of the body. Now, if all these are taken away, the bread must be less nutritious, and therefore of a poor quality, no matter how white or inviting it looks. Now, as the "new process" miller does not desire to get the most flour, but the most money, out of the wheat, he does not care to clean the bran; by running close so as to do this would interfere seriously with his object, and would place him under the necessity of grinding instead of granulating, and from this it may be inferred that it is the color rather than the quality of the flour the miller seeks. There is little if anything gained in this or any other process, no matter how white the flour may be, that does not save the best of the grain for the good of man.—*Miller's Journal.*

Correspondence.

Edison's Electrical Generator.

To the Editor of the Scientific American:

I notice in your last issue a communication from a gentleman named Weston denying certain results which I had stated to the writer of the criticised article regarding the efficiency of my dynamo-electric machine. His statements are without sense or science, and plainly originate from one who does not understand the laws which he pretends to set forth. I append the report of Mr. Upton, my assistant, who has made all the measurements with the Faradic machine.

T. A. EDISON.

Menlo Park, N. J., October 23, 1879.

MR. EDISON: I have read very carefully the communication of Mr. Weston, which you handed me to report upon. It is impossible that the statement quoted by him, that your machine delivers nine-tenths of the electrical energy outside, is mathematically absurd, when it has been found to be practically true.

The assertion that a machine working with nine times more external than internal resistance must be "capable of increasing its own electromotive force nine times without an increased expenditure of power" is utter nonsense. Mr. Weston has evidently confounded the obtaining of a maximum of current with the obtaining of a maximum of economical efficiency. A Faradic machine with a constant field may be considered electrically, when running at a fixed speed, as a battery with a certain E. M. F. and internal resistance. Your machine, for example, has 130 volts electromotive force and about half an ohm internal resistance. According to the reasoning in the letter in question it would be mathematically absurd to connect a battery with a resistance nine times greater than itself, and "destructive of the doctrine of the conservation and correlation of forces," since doing this with a battery is exactly similar to what you have done with your machine in the case mentioned.

To express the results with equations, the outside work may be taken as equal to $E^2 (r + R)^{-2} R$. This will be a maximum when the equation of condition, that the first differential coefficient is equal to zero, is satisfied, or $-2 E^2 (r+R)^{-3} R + E^2 (r + R)^{-2} = 0$, which is the case when $R = r$. This shows the maximum is obtained when the external resistance is made equal to the internal. An experimental proof of this was given in a recent number of *La Lumière Electrique.* For example, in your machine there should a maximum theoretically when R equals 0·5 ohm, E equaling 130 volts, or when $\frac{130 \times 130}{1 \times 1} \times 0{\cdot}5 \times \frac{44{\cdot}3}{33{,}000} = 11$ horse power can be utilized outside of the machine, while as many are lost in the machine. Again if $R = 9r$, as in the case mentioned for illustration in the SCIENTIFIC AMERICAN, that is, R = 4·5 ohms, $\frac{130 \times 130}{5 \times 5} \times 4{\cdot}5 \times \frac{44{\cdot}3}{33{,}000} = 4$ horse power can be utilized outside of the machine. In the first case, as compared to the second, 25 times as much power is lost in order that 2¾ times as much useful effect may be obtained.

Seeing that Mr. Weston has failed to understand this statement, though expressed clearly in the article he criticises, his talk about your denying the truth of Ohm's law is highly ridiculous, as well as his boastings about exposing your so-called absurd theory. His placing a few letters and equations in his letter makes more absurd the total lack of power he has to apply them.

FRANCIS R. UPTON.

The Ice Cave of Teneriffe.

To the Editor of the Scientific American:

Having read in your valuable journal several articles or communications on the subject of "ice caves," and this island having one, which perhaps is the only one of its conditions and circumstances on the globe, I propose to give you some account of it. In giving the facts I do not pretend to explain them, but, on the contrary, would be pleased if some of your scientific contributors would give a satisfactory explanation of the phenomena which I will proceed to describe.

The ice cave is situated on the "Peak of Teneriffe," over 10,000 feet above the level of the sea, and nearly 2,000 feet from the summit. The point that most calls my attention is, not that it exists there (as it is quite cold there even in summer), but the fact that the mountain is an extinct volcano, and by many supposed to be only slumbering now. Nor is this the only point that merits remark, for there is the added fact that the water in the cave is not congealed on the surface, but on the bottom.

The cave supplies the ice consumed in these islands, from which it may be inferred that the quantity is not insignificant.

The mouth of the cave is an opening or well hole, in what seems to be an immense pile of bowlders; the mouth is irregular in shape, and about two yards square. The entrance is made by being lowered perpendicularly some 15 feet to terra firma, where one finds himself on a small plat of earth and stone, say five yards square, and almost surrounded by what seems a small pond of clear water. After the eyes are a little accustomed to the dim light the visitor can see the walls of the cave, which are of earth and stone. The cave is about 100 feet long by 30 feet wide, with roof 10 to 15 feet in height.

The water is from 1 to 2 feet deep over the ice, which has to be dug out with pickaxes. The ice is not like that in our American waters, being granulated and coming out in irregular shaped lumps, from the size of an egg to that of a man's head. When extracted it is found more or less dirty from the earth and pebbles mixed with it. It serves, however, for medicinal purposes, and for making ice creams, etc. In several places the water drops slowly from the roof, but the chief supply seems to trickle through small crevices in the walls.

Some distance higher up the mountain, and some 400 yards away from the cave, there are seen a number of jets of what seems smoke or steam issuing from small crevices in the rocks, and on applying the hand the heat is found to be insupportable for even a moment.

I give these facts from a personal experience, and can vouch for their veracity. They appear to me to be of such a peculiar nature when considered together that they should merit the attention of scientific minds. H. B. M.

Santa Cruz de Teneriffe, Canary Islands, October, 1879.

A Puzzle for Future Geologists.

A singular discovery was made during last year's dredging operations of the Coast Survey Steamer Blake, in the Caribbean Sea; a discovery which should furnish a lesson of caution to geological observers and theorizers.

While dredging to the leeward of the Caribbean Islands large accumulations of vegetable matter and of land *débris* were brought up from deep water, many miles from shore. It was not an uncommon thing to find, at a depth of over 1,000 fathoms, and some 10 or 15 miles from land, masses of leaves, pieces of bamboo and of sugar cane, dead land shells, and other land *débris*, which were undoubtedly all blown out to sea by the prevailing easterly trade winds, and frequently masses of vegetation, more or less waterlogged and ready to sink, were found floating on the surface of the sea. The contents of some of the trawls would, indeed, have sorely puzzled a palæontologist if he had met them in a fossil state; amid deep water forms of fishes, crabs, echinoderms, sponges, etc., would be found orange and mango leaves mingled with branches of bamboo and nutmegs, so that it would have been difficult to decide whether the marine or the land fauna predominated. Such a find in a fossil deposit would probably be explained as having occurred in a shallow estuary surrounded by forests. It is not without interest to observe that this large amount of vegetable matter thus carried out to sea seems to have increased in certain localities the number of marine forms of life.

Carpeting the Mississippi at New Orleans.

In a recent issue the New Orleans *Times* states that nearly all the first appropriation for laying cane mats along the river front, in the second and third districts of Orleans Parish, has been expended in the work.

Another appropriation of $60,000 was made in April last, and the department had advertised for bids upon the work, returnable on the 20th of October. The laying of the mats is done in a more satisfactory manner than ever before, as the men have greatly improved in skill by experience. The regular rate of speed now is two mats per diem, each mat having a length of two hundred feet and a breadth of twenty-six feet.

The mats are laid so as to lap over upon one another about six feet on each side, and are weighted down to the bottom of the river by long canvas bags filled with sand. In September the workmen were engaged below Elysian Fields street. The work in the upper district will be begun when the lower work is finished. The latter is by far the most important, and, owing to the presence of projecting wharves and of shipping, most costly and most difficult.

Completion of Cologne Cathedral.

The first stone of the Cologne Cathedral was laid August 15, 1248, and it is thought it will be completed in another year. The two towers have now reached their last stage, and have only to be fitted with their massive caps of solid stone work. For this purpose two great scaffoldings have to be erected at a dizzy height; one of them, however, already approaches completion. When the caps have been finished then a still higher story will have to be added to the scaffolding, in order to fix on the tops of the caps the gigantic foliated crosses, almost thirty feet high, which are to crown the towers. This operation will, it is expected, be performed next spring.

ACCORDING to Gerard von Schmitt, physician and traveler, the plant *Mikania guaco* possesses medicinal properties very efficacious in the treatment of cancer and allied diseases.

© 1879 SCIENTIFIC AMERICAN, INC

FABER'S GOLD PEN AND PENCIL FACTORY.

[*Continued from first page.*]

melted and alloyed to make it 16 carats fine and cast into ingots suitable for rolling; it is then rolled down to a long narrow ribbon, from which the pen blanks are cut out by means of a lever press, as shown in one of the upper views.

The blank is considerably thicker than the finished pen. The nib of the blank, which is now quite blunt, is notched or recessed at the end to receive the iridium forming the exceedingly hard point which all good gold pens possess. The iridium is coated with a cream of borax, ground in water, and laid in the notch formed in the end of the blank. It is then secured by a process of sweating which is nothing more nor less than melting the gold of which the pen is formed, so that it unites with the iridium as solidly as if the whole were a single piece of metal. This operation, as may be imagined, requires the utmost care to prevent the complete fusion of the gold while heating it to a sufficiently high temperature to insure the union of the two metals. The blank, which is now much shorter and thicker than the finished pen, is passed between rollers of peculiar form, to give a gradually diminished thickness from the point backward; the rolls have a small cavity over which the extreme end of the iridium pointed nib is placed, to prevent injury to the iridium. The blank is rolled several times through this machine to give it the proper length and thickness. After rolling, the nib of every pen is stiffened and rendered springy by hammering. This is an important step in the manufacture of the pen, as the elasticity of the nib depends entirely upon this operation.

The pen blank is now somewhat out of shape and requires trimming to give it approximately its final dimensions. This trimming is done by a press something like the one used in cutting out the blanks. After trimming, the name of the manufacturer and the number of the pen are stamped on the blank—which is still flat—by screw presses, several of which are seen near the center of the larger view.

The next operation—that of giving the pen its convex form—is also performed by means of a screw press, the blank being pressed between a concave lower die and a convex upper die. Several blows are required to bring the pen up to the required convexity, and when this operation is completed, two jaws approach the blank and press it upon opposite edges over the sides of the upper die, and give the pen its final shape.

The next step in the manufacture is to cut the iridium into two points, by holding it on the edge of a very thin copper disk, which is charged with fine emery and oil, and revolved at a high speed. The nib is then slit by the machine shown in one of the lower views, and the slit is cleared by means of a fine and very thin circular saw. After slitting, the nibs are brought together by hammering, and the pen is burnished on the inside in a concave form and upon the outside upon a convex form. This gives the pen a uniform surface and increases its elasticity. The nibs are set by the fingers alone.

The grinding lathe shown in one of the upper views has a spindle carrying a thin steel disk and a copper cylinder, both of which are charged with fine emery and oil. The slit is ground by the thin disk, and the sides of the nibs and the points are ground upon the copper cylinder.

During the process of grinding, the points are examined from time to time with a strong magnifying glass, and when the grinding is complete, the pen is polished upon buff wheels, thoroughly cleaned, and then passed over to the inspector, who weighs and tests it.

These various operations are conducted in the department illustrated by the larger view in the engraving. The lower interior view represents the pencil making department, where gold pen and pencil cases or holders are made. One of the modern pencil cases, which is extended by simply pulling one end, is a marvel of compactness. Some seven or eight pieces slide one over the other. The portion drawn out carries a spirally slotted tube which engages a pin projecting from another spirally slotted tube, and revolves the tube so that it moves the lead-carrying portion of the pencil outward. The extreme end of the spiral slot of the inner tube ends in a straight or circumferential slot, which receives the pin projecting from the lead-carrying device, and prevents the latter from moving backward when pressure is exerted on the pencil point.

The various sizes of tubes required in the manufacture of pen and pencil cases are made in the pencil department. The blanks are first cut from the sheet and bent roughly into semicircular form by hammering into a grooved block. They are then drawn through a plate to bring their edges together, when they are ready to be soldered. For the internal brass tubes silver solder is used. It is applied in a finely divided state along the seam together with a little liquid borax. The soldering is accomplished by moving the tube lengthwise in a trough formed of thin firebrick under a huge roaring blowpipe flame, which is directed into the trough. The flame is urged by a blast from a bellows, and the tube becomes hotter and hotter until the particles of silver solder melt and look like little globules of mercury, an instant more and the melted solder runs into the seam, and the operation is complete. Gold soldering is quite similar, the only difference being that the gold is applied in a thin strip instead of a powder, the strip being drawn into the seam in the tube.

After soldering, the tubes are cleaned and drawn down to the required size on a draw bench. Most of the tubes are drawn upon a mandrel to insure equality in the internal and external diameter of the different tubes of the same nominal size.

The tubes are cut into different lengths for different purposes by a circular saw, having a gauge for regulating the lengths. The spiral slots are formed in the internal tubes of the "magic" pencil by a very ingenious and simple device, which consists simply of a tubular guide placed diagonally across the edge of the saw, the angle formed with the side of the saw corresponding to the pitch of the spiral to be cut. The tube being inserted in the guide and brought in contact with the edge of the saw has a short diagonal slit cut in it, and it is now pushed forward and at the same time allowed to turn, when a slit will be cut, having a true pitch from end to end.

The several operations in pen and pencil case making are carried forward by workmen who have acquired skill by long practice, and who, under the guidance of an able superintendent, make and assemble the parts rapidly. Each workman has a special piece, which he makes carefully and perfectly, so that when all the parts are brought together there is no difficulty. All of the pieces work together smoothly.

The tubes forming the outer case are drawn in plain corrugated dies, and are ornamented by chasing, engraving, or knurling.

It would be futile to attempt to describe in detail the different operations in pen and pencil case making in an article of this character, as the great variety of ways in which they are made would require an entire volume to properly describe them.

While all of the goods manufactured by this house are justly entitled to the reputation they have earned, the gold pens are deserving of especial notice, as they are not only made with the greatest care and of the best materials, but, by the test of use, have proved a very superior article.

THE ABUSE OF LIVE STOCK ON THE WAY TO MARKET.

The American Humane Association—formerly styled the Society for the Prevention of Cruelty to Animals—held its third annual convention in Chicago the second week in October. The attendance was small, but the subjects discussed were of national importance. Chief among them was the treatment of live stock on the railways, and at their halting places between the feeding grounds of the West and the markets of the East. In his opening address, President Brown dwelt particularly upon the cruelty which characterized the treatment of stock by shippers and yard men. While in transit the cattle are kept for days together without food or drink, and multitudes arrive at Chicago dead or nearly dead from the tortures they have undergone. At Chicago, he said, a sifting out process has been inaugurated, the crippled and diseased animals being picked out and sold in that market for food, while the sound survivors are forwarded to New York.

The report of the executive committee, prepared by Mr. Geo. T. Angell, was largely devoted to the same topic. The fullest information, however, was embodied in the report of Mr. Zadok Street, who, during the past six or seven months, had traveled a distance of 18,000 miles over the cattle-carrying roads of the country, for the purpose of observing the condition of animals when shipped from the West, their treatment in transit, and their condition on their arrival in Eastern markets. In the prosecution of these studies, Mr. Street inspected 1,340 local stations where animals are collected for shipment. To a large extent he found the pens unfavorably situated, the ground low and level, and in wet weather very muddy. In many pens he saw cattle and hogs standing in mud from four to eight inches deep, without shelter from the hot sun and exposed to storms, day after day, while waiting to be shipped, their suffering aggravated by an entire lack of arrangements for giving them food or water. He had seen cattle thus confined in Kansas in hot weather three days and nights without food or drink, previous to shipment. And the man in charge said he had been ordered by their owner to ship them to St. Louis without feeding or watering. On their arrival the owner expected to get 100 pounds of water into each of them before they were weighed. He had shipped thousands of cattle, and claimed that such treatment did not hurt them in the least, even in extremely hot weather. No experienced shipper, he said, would allow cattle to be fed or watered within twenty-four hours of their being loaded into cars for a long journey. It is proper to add that wiser and more humane shippers—we trust the majority of shippers, though Mr. Street speaks of them as few—who condemn in strong terms this manner of treating animals in transit, and never allow their stock to be overcrowded or to suffer for lack of food or drink or rest.

In respect to overloading cars, Mr. Street said that it is no uncommon thing to see from eighteen to twenty head of large fat cattle in a car twenty-eight feet long and eight feet wide, and thirty-six to forty-eight of 1 and 2 year old cattle in a car. Also 120 stock hogs in each deck of a double-decked car, and from eighty to ninety large fat hogs in single-deck cars, where there did not appear to be standing room for them.

He had seen 100 large fat sheep forced into each deck of a double-decked car in extremely hot weather; large fat cattle, cows, young calves, and hogs overcrowded in the same car, some of the calves lying down and hogs eating the calves while yet alive! Also, large bulls in the same car with smaller cattle, the former goring the latter. He had seen hundreds of cars with cattle so overloaded that there was hardly standing room for them, and they would use all their strength to get relief until some became exhausted and fell or lay down. In that condition they were trampled upon by their fellows.

While this subject was under discussion at one of the sessions, Captain Gray, of the Lake Shore Railroad Company, said that the shippers were mostly to blame for the damage to cattle. The cure for the evil of overcrowding cars was to be found in the substitution of weight rates for car rates by the railroad companies. When the charge was for weight there could be no gain in and no excuse for overloading. All the roads leading East from Chicago had adopted the system of weighing, and, as a consequence, the sufferings of cattle on the road had been greatly mitigated. Another source of suffering was cut off by forbidding the shipment of mixed car loads of cattle and sheep or hogs. This the Lake Shore road no longer permitted. Mr. Hoxie, the live stock agent of the same road, pointed out another and the chief source of injury, namely, in loading and unloading. The oftener cattle were loaded and unloaded the more they were punished. They could not be loaded and unloaded without doing themselves much injury, and, after one experience, they fought against reloading, and necessarily bruised one another. The handling of stock at Chicago is now done with much less cruelty than formerly. The iron pointed goad has been done away with; and where ten animals used to be taken out dead, but one is pulled out now, showing a decided improvement in methods of handling.

Dr. George L. Miller, of Omaha, gave an account of the methods still prevailing west of the Mississippi, from which it is evident that the society has much to do in that region. The worst that Mr. Street saw was fully confirmed. The pike is still commonly used there, and the treatment of the cattle "infamous and cruel beyond the power of words to express."

Mr. Street said that cattle could be shipped without injury; he had seen them after a long journey come out as fresh and strong as when first put in; and Mr. Levick, of Philadelphia, gave reports equally gratifying, one firm in that city losing but 8 head of cattle out of 1,800 shipped, the rest coming out in as good condition as when they left home. On the other hand, Dr. Miller had seen cattle driven to mania by their sufferings, so that they had to be shot. Between these extremes a terrible amount of needless suffering is possible, suffering which the entire community is injured by, bodily as well as sympathetically, for tortured animals cannot furnish wholesome meat. In taking up this subject, and in their efforts to mitigate the vast amount of misery the cattle traffic now involves, the Humane Association is doing a work likely to be as beneficial as it is noble.

The Brain of an Anthropologist.

M. Asseline, aged forty-nine, belonged to a "society for mutual autopsy," and the examination of his brain was made by his bereaved *cosocietaires*, who were prepared to find in it all the commonly received external indications of a highly refined and intellectual nature. He had been a republican and a materialist; possessed enormous capacity for work, great faculty of mental assimilation, and an extraordinarily retentive memory; had a gentle, kindly disposition, keen susceptibilities, refined taste, and subtle wit. As a writer he had always displayed great learning, unusual force of style, and elegance of diction; and in his intercourse with others he had been unassuming, sensitive, and even timid. But "the autopsy showed," says *Nature*, "such coarseness and thickness of the convolutions that M. Broca presumed them to be characteristic of an inferior brain. The fossæ or depressions regarded by Gratiolet as of a simian character and as a sign of cerebral inferiority, which are often found in women, and in some men of undoubted intellectual inferiority, were very much marked, especially on the left parieto-occipital. But the cranial bones were at some points so thin as to be translucent; the cerebral depressions were deeply marked, the frontal suture was not wholly ossified, a decided degree of asymmetry was manifested in the greater prominence of the right frontal, while, moreover, the brain weighed 1,468 grammes—*i. e.*, about sixty grains above the average given by M. Broca for M. Asseline's age." The report was made by M. Thulié to the Paris Anthropological Society, of which the deceased M. Asseline was a member.

The Speed of Ice Yachts.

We take pleasure in recording the fact that President Barnard and Professor Loomis have both written to the *Post* retracting their assertions as to the inability of ice yachts to outspeed the wind that drives them. They find on examination, as every one must, that such a result is not only a mechanical possibility, but has been practically demonstrated scores of times by Hudson River yachtsmen whose testimony cannot be gainsaid.

The moral of controversies of this nature was happily expressed by the Yankee poet, long ago: "Don't never prophesy unless you know!"

THE Belcher mine of the Comstock lode, Virginia City, Nevada, has now reached the great and remarkable depth of 2,920 feet.

© 1879 SCIENTIFIC AMERICAN, INC

A FEW RECENT INVENTIONS.

The variety of inventions shown in the annexed engraving indicate that American inventive genius is not confined to any particular line of inventions. The devices represented are all simple, and of a class that would be called small inventions, a class that pay better, as a rule, than the larger inventions.

The mouse trap shown in Fig. 1 is the invention of Mr. Caleb H. Hollingshead, of Washington, N. J. It consists in providing a jar or bottle with a tube that fits the neck, and has converging wires on the inner end, which permit the animal to enter, but will not allow it to escape.

Fig. 2 represents an improved stopper invented by Mr. Richard T. Ellifrit, of Platte City, Mo. It is intended for bottles and jars, and forms a scoop by which the contents of the jar may be handled or measured. The great advantage in the use of this stopper is that every jar will have its own stopper, and the contents of different jars cannot become mixed.

A novel sprinkler for sprinkling clothes, plants, tobacco, etc., shown in Fig. 3, is the invention of Mr. J. H. O'Connor, of Helena, Ark. It consists of a goblet-shaped metallic cup closed by a convex perforated plate or rose, and having a valve to permit of the escape of air as the cup is filled. After filling the air valve is closed, and the liquid is discharged in a fine spray by shaking the sprinkler.

An improved fastening for mail bags, patented by Messrs. H. S. Mertz and H. T. Worman, of Allentown, Pa., is shown in Figs. 4 and 5. It consists of a plate carrying a stud and attached to the bag at one side of the mouth, and a series of perforated plates, also attached to the bag at the sides of the mouth, and adapted to the stud. The bag is closed by placing all of the perforated plates over the stud and slipping a concave cap over all, securing it with a padlock, the hasp of which passes through an eye in the stud.

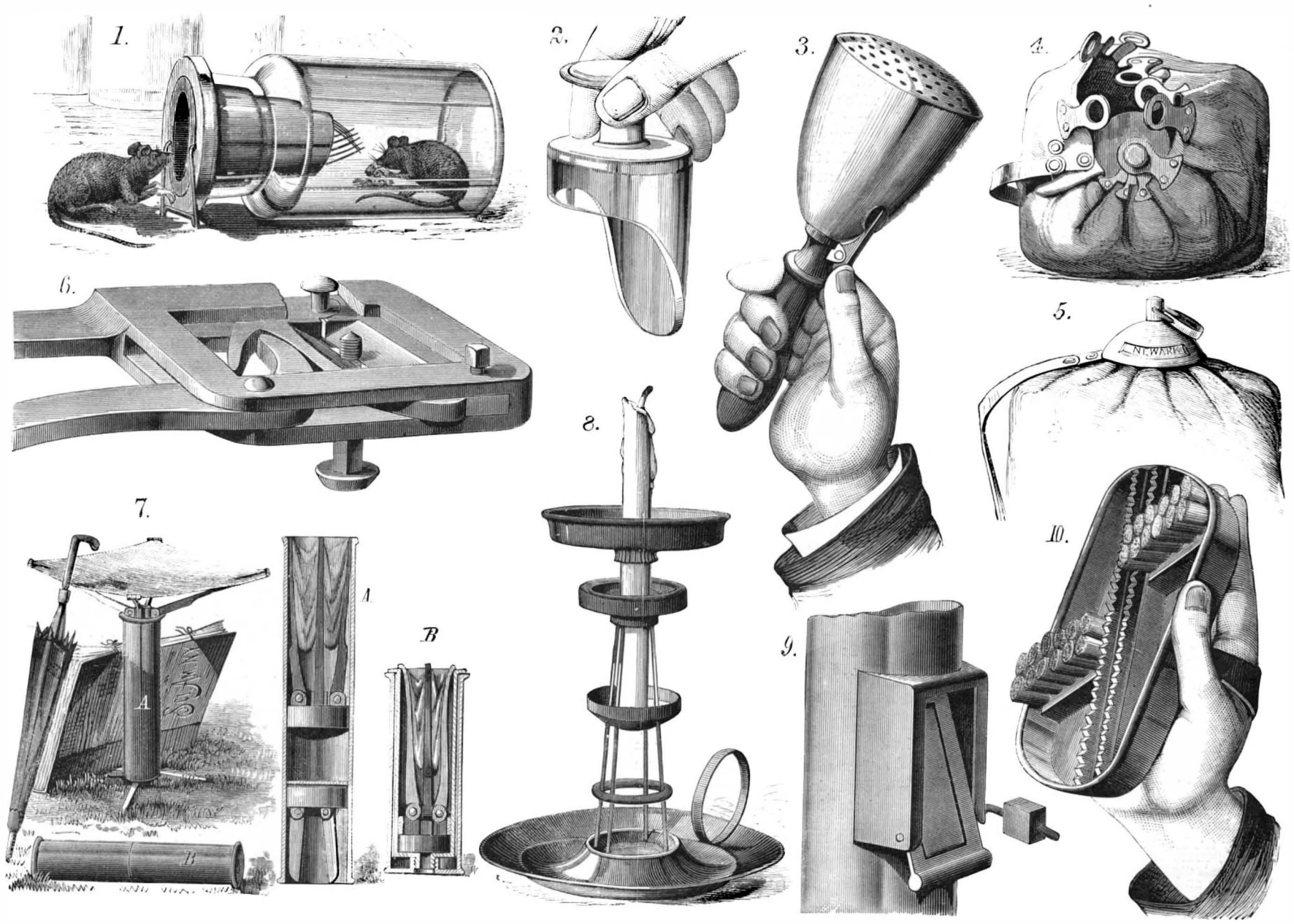
The bolt trimmer shown in Fig. 6 is the invention of Mr. William Butler, of Philadelphia, Pa. It is intended for trimming bolts close to the nuts, and it consists of a frame formed on the end of the fixed handles, and carrying one of the cutter blades, the other blade being pivoted in the frame and operated by a cam formed on the end of the movable handle.

Fig. 7 represents an improved camp stool invented by Mr. Elisha Waters, of Troy, N. Y. The seat is made of flexible material and attached to arms, which fold up and may be pushed down into the tubular standard, A, when the stool is not in use. When the stool is provided with legs they too may be folded and pushed into the tube. When no legs are used the tube may be made in two sections, and one half may be unscrewed and inserted in the other half, thus diminishing the bulk of the stool when it is not in use. The inventor prefers to make the tubular standard of paper, as it is sufficiently strong, and is very light and inexpensive.

The improved candlestick shown in Fig 8 is the invention of Henry Grom, of Newark, N. J It is designed for candles of different sizes, and is arranged to hold them at any desired height. The candle is supported by four spring wires, which are bent outward at their upper ends, and project through a collar in the guide ring at the top. The wires are adjusted by moving the ring which surrounds them near the base, and the lower end of the candle is supported by a shifting plate, which slides upon the wires. A drip plate is adapted to the candle.

Mr. H. W. Taber, of Ann Arbor, Mich., has patented an improved automatic damper to be attached to the pipe, smoke stack, or chimney above the furnace or stove. It consists of a damper nicely balanced, so that an increase of draught beyond the prescribed limit will overcome the counterweight and draw air in through the damper. By sliding the counterweight the resistance of the damper to external pressure may be varied.

The improved currycomb and brush shown in Fig. 10 is the invention of Mr. John Gawthorpe, of Cleveland, O. It consists of a plate shaped like a horse brush, and having a projecting flange, to which are secured currying teeth and brushes arranged diagonally across the plate. With this device a horse may be brushed and curried at the same time, and the dirt and hair will be retained by the projecting flange.



RECENTLY PATENTED NOVELTIES.

COST AND TRAFFIC OF THE NEW YORK ELEVATED RAILWAYS.

From the testimony of Mr. W. R. Garrison, President of the Manhattan Elevated Railroad Company, and also of the Metropolitan, given before the Assembly Committee on Railways, October 15, it appears that the actual cost of the Metropolitan road was over $800,000 a mile. The cars cost $3,400 each, and the engines from $5,000 to $5,200. The road had 50 engines and 150 cars. Fifteen miles of road had been finished when it was leased to the Manhattan Company. Mr. José F. de Navarro, a director, said that the cost of the road would be 40 per cent greater now if it were to be built again. As much as $100,000 had been expended in efforts to lessen the noise and get rid of smoke and cinders. The noise had been diminished a half by the experiments and by the wearing of the rails. He thought the road would cost $1,000,000 a mile when everything was completed. Mr. Benjamin Brewster, a large stockholder in the New York Elevated Company, said that the cost of that road, including rolling stock, was $700,000 a mile.

There was submitted to the Committee an official statement of the traffic on the three roads during the months of July, August, and September; also the revenue and the average fares. The following is a summary:

	Passengers.	Revenue.	Average Fares.
Third Avenue.....	6,936,924	$513,854.05	7.41
Ninth Avenue.....	919,487	65,803.10	7.15
Sixth Avenue	4,156,545	327,305.45	7 88
Total	12,012,956	$906,962.60	7.55

As the three months represented are those of least traffic —covering as they do the season when business is most quiet, and the largest number of our citizens are out of town —the evident increase of traffic for the year is enormous. Part of this increase is due no doubt to the extension of the roads, but vastly more to the largely augmented volume of general business.

The Torpedo Catcher.

A trial has been made on board the Bloodhound, gunboat, at Portsmouth, England, of a new means for clearing harbors of sunken mines and fixed torpedoes. At present, the method adopted is to destroy the engines by countermining, or by the hazardous process of "creeping." This is effected by boats being sent out to grapple for the cable connections, and then severing them by small charges of gun cotton. This mode, however, is very slow. The new method of opening a free channel for the passage of ships, as tried in the Bloodhound, consists in running out a couple of booms, 30 feet in length, from the bows of the ship. Across the submerged ends is fixed a horizontal beam, 38 feet in length, having a zigzag arrangement of iron rods in the form of a W, the idea being that the open space of each V of the series, as it is pushed through the water, will inclose the torpedo fastenings or connections, and lead them to the point at the bottom, which is fitted with a scissor contrivance, the blades of which are worked by levers in connection with the capstan on board. The beam searcher has a sweep of 50 feet, and the mechanism is capable of cutting through the strongest electric cable. A net, which is supported from the whiskers of the bowsprit, receives the liberated torpedo, and prevents it exploding against the operating craft. The trial proved a great success.

The Locomotive.

The control which a good locomotive engineer has over his engine is something remarkable. A long time ago some of the depot attaches noticed that the 1:15 train from the South seemed to stop daily at the self-same spot when coming to a standstill at the depot, and about two months ago a mark was made to designate the precise locality. Since that time the train has not varied six inches from the mark, and some of the friends of the engineer have presented him a bouquet in acknowledgment of his skill.—*Springfield (Mass.) Union.*

© 1879 SCIENTIFIC AMERICAN, INC

ROMAN GLASSWARE.

One of the engravings on this page represents the opposite sides of the celebrated Barberini or Portland Vase, now in the British Museum, and said to be the most beautiful example known of glass of two layers. This vase, which is about ten inches in height, was found some three hundred years ago in a marble coffin within a sepulchral vault near Rome. From slight evidence the tomb has been thought to be that of the Roman emperor Alexander Serverus, who died A. D. 235. The extreme beauty of the vase led Montfaucon and other antiquaries to mistake it for real sardonyx. More critical examination proved it to be composed of dark blue glass, of a very rich tint, on the surface of which are delineated in relief several minute and elaborately wrought figures of opaque white enamel. Experts in glass-making say that the figures must have been moulded separately, and afterward fixed to the blue surface by partial fusion. The union has been effected with such extraordinary care and dexterity, however, that no trace of the junction can be detected, nor have the most delicate lines received the slightest injury. The work is supposed to date from about 138 B. C. For two centuries after its recovery it was the principal ornament in the Barberini palace in Rome; then it was purchased by the Duke of Portland for £1,029, and placed in the British Museum.

THE BARBERINI OR PORTLAND VASE.

A feature peculiar to Roman glassware was the production of "double" glassware. This was composed of several layers of glass of different colors. The innermost layer was either quite dark or very light, and was covered by a layer formed of various figures and decorations in different colors, and covered by a third transparent layer. In this way very beautiful effects were obtained. The precise way in which these goods were produced is not known, and we have not been able to produce anything of this character equal in beauty to the few examples of this ware that have been preserved.

Paper from Grass.

One of the subjects of a recent patent is the manufacture of paper pulp and paper from common grass. The patentee claims that grass treated when green and reduced to pulp, has a very flexible, silky, long, and tenacious fiber, which, when made into paper, assimilates linen paper, and, if anything, possesses greater softness and transparency. Any of the common field, lawn, or meadow grasses can be used, and for this purpose it is best that the grass should be cut or mowed before it begins to bloom; but young or old may be used so long as the sap is yet in circulation and the chlorophyl, silica, and other organic and inorganic matters are not dried in, which is found to make a serious change in the quality of the fiber for the purpose of paper.

After the grass is cut or mown it is passed between the rollers of a "roller press," which squeeze out the main portion of the sap and crush or loosen the fiber. When the grass has been passed through the roller press, it is next placed in a large tank of water, in which it is thoroughly washed by agitation or other suitable means, so as to remove the dirt. The water of the tank may be either warm or cold, and the tank is constructed with a perforated "false bottom," on which the crushed grass rests and through which the dirt falls into the compartment below, from which a pipe extends to allow the dirt and wash-water to escape. When the crushed grass is sufficiently washed it is boiled in an open kettle or in a steam kettle with lye, in proportions of about one tenth of a pound of caustic soda, or two tenths of a pound of caustic potash, or six tenths of lime to one hundred pounds of grass. The boiling is continued when an open kettle is used for from four to five hours, but when a steam kettle is used, two hours will suffice.

After the boiling operation is completed the material is removed from the kettle and put into a feltering trough, in which it is beaten and feltered from one to two hours. After this it is washed until clean in clear water.

The coarse pulp or felt thus produced is refined and bleached for the production of fine papers as follows: It is first placed in a cold solution of carbonate of soda for about fifteen minutes; next in a dilute solution of sulphuric acid for about the same time, and again in a solution of carbonate of soda. It is then placed in a solution of chloride of magnesia for about thirty minutes, and after this it is placed a third time in a solution of carbonate of soda; and, finally, a second time in a solution of sulphuric acid. These operations may be repeated more or less till the pulp is as fine and white as required, after which it is finally washed in clear water. Another method is to felter the crude pulp with water glass and bleach it with a solution of chloride of lime or chloride of soda. Still another is to bleach the crude pulp in chlorine gas, then in a solution of chloride of soda, and finish with water glass, after which the pulp is washed with clear water.

Papers produced from this green grass pulp are said to possess the qualities of great strength and length of fiber, tenacity, softness, and flexibility. For tissue, drawing, writing, and copying papers the material is said to be admirably adapted, as it provides a fine writing surface and superior transparency even without the use of any size.

In its economical aspect, one square foot of ground gives, in the whole year, from 0·7 to 1·5 of a pound of green grass, making from 30,492 to 65,340 pounds to the acre. One pound of green grass makes one fourth to one sixth of a pound dried, or 11,979 pounds dried grass to an acre. Finally, one pound of dried grass gives about one third to one fourth of a pound of fine bleached and finished paper, or 2,911 pounds of finished paper to the acre of ground.

ANCIENT ROMAN GLASSWARE.

The Great Locomotives of the Erie Railway.

A correspondent of the New York *Times*, writing from Port Jervis, states that when the Erie Company (now New York, Lake Erie, and Western) commenced preparations to lay a third rail, plans were drawn by the chief engineer, Octave Chanute, for a class of large locomotives, which would be narrow gauge, weighing fifty-two tons, and with eight wheels. It was thought that a class of engines such as this could be used to advantage on the heavy grades on the Erie. Four of these large locomotives were constructed at the shops of the company at Susquehanna. These were tried upon the Jefferson Branch, a road that extends from that place to Carbondale, Pa. This road is thirty-eight miles long, and consists of two hills, each nineteen miles long, where may be found the heaviest grade on the Erie lines. Proving satisfactory, a contract was given to the Grant Locomotive Works, of Paterson, N. J., for thirty locomotives, to comply in every particular with the specifications of the company. These engines were numbered from 520 to 549 inclusive, and were delivered during the winter of 1878–9. Four of these locomotives were put upon the Delaware Division and twenty-six upon the Eastern, and it was upon the latter that the most difficulty was experienced. But as summer approached the large engines became more manageable, and more cars were added to their complement, until at last a maximum number was attained. This was a train of forty loaded cars. Starting from Port Jervis with forty cars, they are assisted up the "hill," extending from this place to the top of the Shawangunk Mountains, a distance of nearly twelve miles, by a pusher engine; then they draw their trains to what is known as Goshen grade, a short hill just west of that village, which is less than a mile long, and here assistance is needed. From there to Greycourt they proceed alone. At this point the heaviest grade on the Eastern Division commences. It is less than three miles in length, but assistance is required. Arriving at the top of Oxford, as it is called, they enter the Ramapo Valley, and from there to Jersey City they need no help. At Port Jervis there are five pushers, at Goshen one, and at Greycourt two, each manned by gangs of two men, working alternately night and day. Altogether there are eighteen gangs of men which are needed to assist these large engines with their trains of forty cars, and it might look to those who are not acquainted with the manner in which the business was formerly conducted, that the road had gained nothing. But to show how deceptive are appearances, it is only necessary to present the other side of the case.

Formerly there were two classes of locomotives—four and six wheel connected—the former starting from this place with sixteen cars and the latter with eighteen and twenty. They were not provided with pushers at any point with the exception of Oxford grade, where one pusher was kept. But it was the exception to use it. Arriving at Turner's, forty-two miles distant from here and forty-five from Jersey City, the trains "filled out" with ten cars, their trains from that point consisting of twenty-six, twenty-eight, or thirty cars, as the case might be. To secure their complement of cars, it was necessary to have them transported there, and this was done by "turning" one third of the gangs and sending them back to Port Jervis. No light or empty cars were to be secured, except such as were lying at way stations, and generally one or two engines were sufficient to do the work, and consequently eight out of ten came back "empty," the gang of seven men taking it easy, generally all but the fireman going to sleep in the caboose, leaving him to run the engine and

© 1879 SCIENTIFIC AMERICAN, INC

caboose to Port Jervis. For this they were paid at the rate of one day. Consequently, where it formerly took thirty engines to haul six hundred cars over the road, it now only requires fifteen, assisted by the pushers stationed at the various points. Dividing the sixteen additional "pusher" gangs, or forty-eight men, by seven, the number comprising an ordinary freight gang, gives about seven full gangs, which, added to the fifteen saved in the number of trains, makes twenty-two, leaving a clear saving to the company of eight gangs of men and eight locomotives in hauling six hundred cars from Port Jervis to Jersey City. In handling the traffic of the Erie, which ranges from twelve hundred to two thousand cars daily, the cost is correspondingly decreased as regards the pushers, as the same number is used for the greater traffic as for the less. In handling twelve hundred cars, sixteen gangs are dispensed with, and eighteen hundred, twenty-four gangs. The time consumed in running between these points is not much lengthened. The experience thus gained resulted in the ordering of ten more of these monster locomotives, which have just been placed upon the road.

Keeping the Boys on the Farm.

In an extended argument as to the desirability of farmers' sons sticking to the farm, the Cincinnati *Commercial* observes that there is a feature in this matter of sons following the calling of their fathers that is not sufficiently regarded.

"The calling of the father may rise to a higher dignity when the sons adopt the business, thoroughly learn it, and zealously and proudly pursue it. Then the accumulated reputation, capital, and business of the parent can be inherited and preserved by the sons.

"Again, it is a law of nature that holds good in all the animal kingdom, that aptness for any business may be inherited, or may be bred, as we say of stock. The great desideratum in developing a race of trotters is to insure an aptness to trot. And this comes not from stock that has habitually been used for the draught or chase or race course. If the dam trots and the sire trots we do not expect the offspring to be a running horse.

"The old Spartans understood this law of developing an aptness for a given calling in the children. The Germans of olden times developed a race of warriors on the same principle.

"The law of heredity is so broad and so powerful in its influence that it extends not only to color and form of our race, but it extends to the temperament and even to the tastes. The taste, though like the muscle and reasoning faculties, may be improved by education. Still the taste for and aptness for any calling may be increased from generation to generation.

"Then, if we are to reach the highest development as a race of farmers, we must expect it through the line of descent. The son must inherit the fitness of the father, and take up the calling and business where he left off, and his son after him, and so on. When this shall become the custom in our farming families, then shall we see greater stability in society and a higher type of civilization. Every parent has the chief power to bring this work about. The very independence of the farmer's life is to be the germ which develops a race that can not be other than an independent people. Our nation is to achieve its greatness in the development of agriculture. Its power at home and abroad is to be established and held through the arts of husbandry, practiced by a skillful and virtuous race of farmers. All then that can be done by the state or family to ennoble and to dignify the calling, and to entail its blessings and influence from father to son, will add to the stability and grandeur of the nation."

Rainfall and Forests.

Some interesting observations have lately been made touching the influence of forests on rainfall, at the School of Forestry, Nancy, France. The results of these observations, made during the past six years, are summed up by the sub-director of the school as follows:

1 Forests increase the quantity of meteoric waters which fall on the ground, and thus favor the growth of springs and of underground waters. 2. In a forest region the ground receives as much and more water under cover of the trees than the uncovered ground of regions with little or no wood. 3. The cover of the trees of a forest diminishes to a large degree the evaporation of the water received by the ground, and thus contributes to the maintenance of the moisture of the latter and to the regularity of the flow of water sources. 4. The temperature in a forest is much less unequal than in the open, although, on the whole, it may be a little lower; but the minima are there constantly higher, and the maxima lower, than in regions not covered with wood.

These results substantially corroborate those made by M. Fautrait, when sub-inspector of the forests at Senlis, France, and given as follows:

1. It rains more abundantly, under identical circumstances, over forest than over non-wooded ground, and most abundantly over forests with trees in a green condition. 2. The degree of saturation of the air by moisture is greater above forests than over non-wooded ground, and much greater over masses of *Pinus sylvestris* than over masses of leaved species. 3. The leafage and branches of leafed trees intercept one third, and those of resinous trees the half of the rain water, which afterward returns to the atmosphere by evaporation. On the other hand, these same leaves and branches restrain the evaporation of the water which reaches the ground, and that evaporation is nearly four times less under a mass of leafed forest than in the open, and two and one third times only under a mass of pines. 4. The laws of the change of temperature out of and under wood are similar to those which result from the observations of M. Mathieu. The general conclusions seem to be that forests regulate the function of water, and exercise on the temperature, as on the atmosphere, an effect of "ponderation" and equilibrium.

ATTRACTION.

In looking over the early volumes of the SCIENTIFIC AMERICAN, a few days ago, the memories of the past were vividly brought to mind by reading the following poetry, which appeared in the first column of the first issue of this paper, dated August 28, 1845. We wondered as we read this how many of our present patrons remember reading the effusion when it first appeared:

Attraction is a curious power,
That none can understand:
Its influence is everywhere—
In water, air, and land;
It keeps the earth compact and tight,
As though strong bolts were through it:
And, what is more mysterious yet,
It binds us mortals to it.

You throw a stone up in the air,
And down it comes—ker-whack;
The centrifugal casts it up—
The centripetal—back.
My eyes! I can't discover how
One object 'tracts another;
Unless they love each other, like
A sister and a brother.

I know the compass always points
Directly to the pole:
Some say the North Star causes this,
And some say—*Symms's Hole!*
Perhaps it does—perhaps it don't;
Perhaps some other cause;
Keep on *perhapsing*—who can solve
Attraction's hidden laws?

A fly lights on a 'lasses cup—
Attraction bids him woo it;
And when he's in, attraction keeps
The chap from paddling through it.
Attraction 'lures the sot to drink,
To all his troubles drown;
But when his legs give way, he falls,
And 'traction keeps him down.

Attraction is a curious power,
That none can understand:
Its influence is everywhere—
In water, air, and land.
It operates on everything—
The sea, the tides, the weather;
And sometimes draws the sexes up,
And binds them fast together.

Do It Well.

Whatever you do, do it well. A job slighted, because it is apparently unimportant, leads to habitual neglect, so that men degenerate, insensibly, into bad workmen.

"That is a good rough job," said a foreman in our hearing, recently, and he meant that it was a piece of work not elegant in itself, but strongly made and well put together.

Training the hand and eye to do work well leads individuals to form correct habits in other respects, and a good workman is, in most cases, a good citizen. No one need hope to rise above his present situation who suffers small things to pass by unimproved, or who neglects, metaphorically speaking, to pick up a cent because it is not a dollar.

Some of the wisest law-makers, the best statesmen, the most gifted artists, the most merciful judges, the most ingenious mechanics, rose from the great mass.

A rival of a certain lawyer sought to humiliate him publicly by saying: "You blacked my father's boots once." "Yes," replied the lawyer, unabashed, "and I did it well." And because of his habit of doing even mean things well, he rose to greater.

Take heart, all who toil! all youths in humble situations, all in adverse circumstances, and those who labor unappreciated. If it be but to drive the plow, strive to do it well; if it be but to wax thread, wax it well; if only to cut bolts, make good ones; or to blow the bellows, keep the iron hot. It is attention to business that lifts the feet higher up on the ladder.

Says the good Book: "Seest thou a man diligent in his business, he shall stand before kings; he shall not stand before mean men."

The Western Union Telegraph.

The annual report of the President of the Western Union Telegraph, for the year ending June 30, 1879, contains a statement showing the mileage of lines and wires, the number of offices, and the traffic of the company for each of the past fourteen years. In 1866 the company owned 37,380 miles of line with 75,680 miles of wire, and had 2,250 offices. The number of messages sent is not given, but would appear to have been about 5,000,000. The increase in traffic year by year has been much more rapid than in the amount of wire or the number of offices. Last year the company had 82,978 miles of line, 211,566 miles of wire, 8,534 offices, and sent upward of 25,000,000 messages, on which the charges were nearly $11,000,000, and the profits $4,800,000 The capital stock of the company is, in round numbers, $41,000,000.

Effects of Atropine and Pilocarpine.

Some interesting experiments on the local antagonism of atropine and pilocarpine were recently communicated to the Académie des Sciences by M. Strauss. If one or two centigrammes of nitrate of pilocarpine are injected beneath the skin of a man, at the end of from two to five minutes the skin covering the injected liquid reddens, and then is covered with very fine droplets of sweat, which appear first not at the point of the injection, but at the circumference of the area, and extend concentrically to the center, finally covering the whole area. This local sweat occurs two or three minutes before the salivation, and five or eight minutes before the general perspiration, and it is the more pronounced the greater is the number of sudiparous glands at the spot; the best places being the forehead or front of the sternum; the back of the arm, where injections are most frequently made, being the least favorable, and for this reason probably the phenomenon has escaped observation. Reducing the dose, the effect of the injection becomes ultimately strictly local, without the slightest general sweating. Thus, at will, this or that part of the skin may be made to sweat, or lines of sweat may be produced on an otherwise dry skin. The dose with which the effect is purely local is from one to four milligrammes.

By means of subcutaneous injections of atropine the opposite effect may be obtained. If, when a person is in full sweat from the effect of pilocarpine, very minute does of sulphate of atropine are injected under the skin, the perspiration lessens at the spot almost immediately, and in a few minutes it is totally suppressed. Thus dry areas and lines may be at will produced upon the moist skin. In order to ascertain that the arrest of the perspiration is really the result of the atropine, and not of the mere injection of liquid, an equivalent volume of pure water was injected at certain spots, but without causing any arrest of the perspiration. The dose of atropine which will arrest the sweating is extremely small. One-millionth of a gramme of atropine never failed to produce it in man, and in the cat one-hundred-thousandth of a gramme was sufficient. The sweating skin is thus a test of atropine of extreme delicacy. The sensibility of the sudiparous glands to atropine is greater even than the iris, since the millionth of a gramme of atropine produces no appreciable dilatation of the pupil.

Treatment of the Hair.

How to preserve the hair is a subject which seems to interest almost everybody, if we may judge from the frequent inquiries from every direction which come to this office. One wishes to know what will prevent baldness, another how to preserve their hair from turning gray, another how to eradicate dandruff, etc. Now it is a delicate matter to recommend any special treatment, but Professor Wilson, of England, who is deemed high authority on the hair, condemns washing it, and advises, instead, thorough brushing. This promotes circulation, removes scurf, and is in all respects, he says, better than water.

Cutting the hair does not, as commonly thought, promote its growth. Most of the specifics recommended for baldness, not excepting petroleum, are mere stimulants, and are seldom or never permanently successful. Some of them give rise to congestion of the scalp. When a stimulant is desirable, ammonia is the best. It is safe.

For falling out of the hair, Dr. Wilson prescribes a lotion composed of water of ammonia, almond oil, and chloroform, one part each, diluted with five parts alcohol, or spirits of rosemary, the whole made fragrant with a drachm of oil of lemon. Dab it on the skin, after thorough friction with the hair brush. It may be used sparingly or abundantly, daily or otherwise.

For a cooling lotion, one made of two drachms of borax and glycerine to eight ounces of distilled water is effective, allaying dryness, subduing irritability, and removing dandruff.

Both baldness and grayness depend on defective powers of the scalp skin, and are to be treated alike. What is needed is moderate stimulation, without any irritation. The following is good: Rub into the bare places daily, or even twice a day, a liniment of camphor, ammonia, chloroform, and aconite, equal parts each. The friction should be very gentle.

High Wind Velocities.

In its review of the hurricane which swept along our Southern Atlantic seaboard, August 18, the Weather Bureau reports that the wind velocities, noted as the central vortex neared Cape Lookout, were among the highest, if not the highest, which have ever been recorded. At Cape Lookout, at 6:30 A.M., of the 18th, the barometer falling very rapidly, the cups of the anemometer were blown away while the instrument was registering a wind velocity of 138 miles per hour. But this was not the maximum. An hour and a half later, as the storm center began to pass away, and the barometer to rise, the wind rose to the estimated velocity of 165 miles per hour. An observed velocity of 100 miles an hour was also reported from Cape Henry. The highest winds attending storms near sea level, with which these can be compared, are perhaps those of the Liverpool storm of February, 1868—from 100 to 120 miles an hour—and those of the great Guadeloupe hurricane of 1865, from 100 to 130 miles.

THE St. Gothard Tunnel, which will measure 14,920 meters when completed, has now reached a length of 13,229 meters. It is hoped that by the beginning of December the gigantic work will be finished.

© 1879 SCIENTIFIC AMERICAN, INC

THE NATIONAL ACADEMY OF SCIENCES.

The National Academy of Sciences began its main annual session, Oct. 28, at Columbia College in this city. Professor Wm. B. Rogers presided, Vice-President O. C. Marsh occupying the chair during part of the time.

In his opening address the venerable president spoke of some of the aspects of scientific research which had specially excited his interest of late.

'It seems," he said, "as if, in the progress of research, the physical sciences, including the biological department, had reached fields of inquiry which promise the widest results for future investigation. In all branches of discovery we seem to be catching the clews of far-reaching thought, that stretch out where as yet no man's foot has trodden. As among some of the most recent of these may be instanced the evidence, amounting almost to proved assurance, by which Prof. Whitney places the existence of man at least as far back as the Pliocene era. The recent developments in chemistry, through the agency of the spectroscope and the effects of heat in dissociation, have suggested, if they have not proved, that a number of the substances hitherto regarded as elements are hereafter to be regarded as compound. The investigation of the laws of chemical action, following out the suggestions made at the beginning of the century by the great chemist, Berthollet, in regard to the influence of mass on chemical reaction, seems to promise most important discoveries in chemical statics and the possibility of applying mathematical reasoning and formulæ to chemical activities. The marvelous series of experiments presented recently by Crookes, in which have been exhibited the wholly unexpected phenomena which he has described under the designation of what was first referred to by Faraday as a fourth form of matter, which this illustrious experimentalist called radiant matter, seemed to open up a field of research and speculation until now wholly undreamed of. In truth, the active scientific workers have now been brought by their refined and novel researches to touch the near extremities of innumerable lines of thought and investigation, stretching out into unknown regions, whose exploration is to occupy the activity and reward the labors of a coming generation."

The first paper was that of Prof Henry Draper, on photographing the spectra of the stars, in the course of which he described the work which he began in 1872. In these researches he has obtained photographs of the spectra of Vega, Arcturus, Capella, Alpha Aquilæ, Jupiter, Mars, Venus, and other bodies. Particulars were given of the methods by which these results were attained. The subject of planetary spectra is for the present reserved, and will be the subject of a future communication. The spectral photographs of Arcturus and Capella seem to be precisely like those of the sun. Those of Vega and Alpha Aquilæ are totally different. They are banded, not lined. It is clear that hydrogen is present to a large extent in the atmosphere of Vega; but it is equally certain that other substances are quite as prominent. Exactly what these bands mean can only be ascertained by a course of experiments on terrestrial materials, On this study Dr. Draper has fully entered. He is not fully of the belief that the lines of calcium are present. He exhibited portions of his apparatus, and illustrated the subject by diagrams of the spectra and by photographs.

The next paper, by Prof. C. A. Young, embodied a number of spectroscopic notes, principally of a technical character. Surgeon General J. J. Woodward also read a paper giving an account of original researches, reported in the second volume of the "Medical and Surgical History of the War of the Rebellion."

In the afternoon, Dr. J. C. Dalton described the results of observations on the structure of the human brain, which were illustrated by numerous drawings and photographs. He held that the white matter of the cerebrum, composed of fibers, is employed for transmission only, the essential operations of the mind occurring wholly in the gray matter. Of this gray matter there are three distinct deposits. Conditions affecting the first, counting from within outward, produce involuntary action; reaching the second, they produce sensation; reaching the third, conscious cerebration. In the discussion which followed Dr. Woodward said that a brain, specially prepared, had been sawed into a thousand slices for microscopical examination.

Prof. Arnold Guyot next exhibited his new map of the Catskill Mountains, and discussed the geological problems of that region. It was originally a table land, and had been carved into mountains by erosion. He did not regard the carving of the mountains as glacial work, though the evidence of glacier scratches was not wanting. The process which had taken place, he thought, was an elevation of the whole district. But at the time of that rise the Adirondack formation was already in position, and by it the Catskill plateau was squeezed as it rose. The mountains which now occupy the place of that plateau were left by erosion, their valleys being carved out by rivers. Prof. James Hall, in the discussion which followed, expressed himself as delighted with the adhesion of so good an observer as Prof. Guyot to the theory of the formation of mountains by erosion, and not by their separate upheaval. Prof. Rogers described an instance where one of the Shenandoah mountains could scarcely have been formed by a separate upheaval, for all its strata were horizontal from bottom to top; but the surrounding region was full of the evidences of disturbance.

The first paper of the second day was by Prof. James Hall, State Geologist of New York, on certain new and remarkable crinoids from the Lower Helderberg formation. Later a second paper was read by the same gentleman on a more ancient fossil of the same order, which had been mistaken for a plant. Prof. Newberry expressed the hope that the new crinoids might help to furnish the missing link between crinoids and sponges. In the absence of the authors the Secretary read a paper by Prof. Elias Loomis, continuing his studies of the meteorology of the United States as exhibited by the Signal Service weather maps; also one by Prof. Asaph Hall, of the Naval Observatory, giving the latest results of his observations on the moons of Mars. A paper by Prof. Stephen Alexander, describing a method of ascertaining the dimensions and ellipticity of the earth, led to much discussion, Prof. S. P. Langley, of Allegheny, specially challenging it as liable to large mistakes, owing to the irregular variations in the lower strata of the atmosphere.

The main paper of the afternoon session, on the old river beds of California, by Prof. Joseph Le Conte, of Oakland, was read by Prof. Scudder, of Harvard. It described at great length the present and recent conditions of the river valleys of California, and the theories which have been offered to account for the filling up of the old river beds. All were declared untenable except the one which explained the matter by true river action. The old rivers, though rapid, filled up their beds because of the vast amount of material they carried. The deposits in the old beds are very coarse, and must have cut fast, in a geological sense. When the deposits were completed, the streams were displaced by the lava floods. Mere deposits would never displace the streams. The deposited materials were held in the snow and ice originally, but were released by the melting of these by the approach of the subterranean heat of the impending lava flow. This may be objected to as savoring of catastrophism; but the obliteration of an entire system could be effected by nothing short of catastrophe. After the lava came the flow of ash, and the new beds were cut in the ash deposits between the lava deposits. This lava flow did not come from craters, but from fissures, and the side squeezing elevated the mountain ranges, so that the new channels appear in the singular relation of being below instead of above the old. We have then the formation of the Sierra Nevada drainage system, lasting through the Cretacian and Quaternian periods, with neither much erosion nor much detritus. The Glacial period was characterized by snow and ice, with loose *debris* prepared for transporting. The melting snow ran down in overloaded streams, alternately scouring and refilling. Then the fissuring of the high Sierras, lava streams obliterating the river system, and ash irruptions followed. New glaciers and rivers then cut new rivers, showing a preference for the old divides. The high Sierras were ice-mantled, and the lower coast range was covered with snow down to the Bay of San Francisco. New channels were cut below the old lava-filled channels, and meteoric waters charged with lime and silica changed the slate and bed-rock into clay.

Prof. Guyot remarked that this paper modified our ideas of the antiquity of man, which might not be, geologically, very great. It showed how insufficient were our data for estimating chronology, and emphasized the necessity for caution.

Professor Marsh said that the labors in this same field of Professors Whitney and King, leading to different conclusions, should be kept in mind. They both agree that there is no doubt of the Pliocene age of deposits, in which occur human remains. The age of the animals discovered by Marsh was clearly Pliocene. If man is found in the same place with these animals he should be considered as Pliocene also. It is important to say that glacial action began in the Pliocene age. He had seen basalt deposits in Pliocene formations, showing volcanic action previous to the glaciers. The animals found were tropical, as the rhinoceros and great sloth, and in this time early man existed.

Prof. Langley read a paper on the absorptive powers of the solar atmosphere, and Prof. O. N. Rood one on our memory for color and luminosity, intended to prove that human capacity in this respect is greater than has been hitherto believed.

Work and Wages in Lowell Cotton Mills.

In a long account of Lowell and its cotton mills, in the Boston *Journal of Commerce*, we find the following interesting facts and figures:

The first of the great cotton mills of Lowell commenced operations in 1823. Now the entire capital stock in the several corporations is nearly $17,000,000.

Whole number of spindles	800,000
" " " looms	19,000
Females employed	12,000
Males "	8,000
Yards made per week—cotton	3,500,000
" " " " —woolen	115,000
" " " " —carpeting	40,000
Pounds cotton consumed per week	1,000,000
Pounds clear wool consumed per week	175,000
Yards of cotton cloth dyed and printed per annum	93,000,000

As a result of the very great changes in machinery since 1860, the work in the factory is not only done better, but at a less waste of material, and the cost of production in labor reduced 25 per cent. Labor is also less arduous. To such perfection has machinery been brought that from 60 to 64 per cent less labor is now required, for a given amount of product, than in 1860. The machinery is also run at nearly double the speed, a single operative now turning out in a given time about one-third more work than it was possible to do in 1860. Three-fourths of all the labor the mills to-day is done by women, and every year the work is more and more coming into their hands.

Until recently the greater part of the machinery used was imported, as it was believed that it could not be made so well at home as in England, but home built machinery, for all purposes, is now preferred. It not only does its work better, but is better adapted to our operatives, and to the American system of management.

Touching the condition of the factory operatives, the *Journal* says that, judging from reports sometimes made, one might expect to find in our New England cities a class of wretched, half starved beings, prematurely old by overwork, discouraged and heartbroken over present hardships and a still darker future. No such class of operatives is found in Lowell, else all outward signs are deceptive. Their homes are found neat and attractive, and somehow old and young manage to dress well. Their tables are supplied with good food, they have spare money for occasional excursions or to attend places of amusement, while many of the more industrious and frugal have respectable accounts in the savings banks; but after all the most telling fact is the large attendance and creditable standing of their children in the public schools.

The following figures were taken from the books of one of the leading corporations of Lowell:

Average earnings of girls per week in 1860	$3.26
Board per week in 1860	1.25
Leaving net earnings per week, 1860	$2.01
Average earnings of girls per week in 1878	$4.34
Board per week in 1878	1.75
Leaving net earnings per week, 1878	$2.59

The facts, therefore, show that in 1860 female operatives, working 11 hours a day (66 hours a week), received $3.26, while in 1878 the female operatives, when working 10 hours a day (60 hours a week), received $4.34. This applies only to one class of operatives, but the average given is found the same with all the other classes.

The changes in the character of the operatives have been no less marked than in the improved machinery brought into use. In the first twenty years the operatives in the mills of Lowell were nearly all Americans, mostly sons and daughters of New England farmers—many coming from New York State—and all attracted by the better wages offered than could be had at home. To-day the operatives are mostly all foreigners, some English and French, but mainly Irish, while the strictly American element is very small. The figures below will show the rapid increase in the foreign population of the city, which is attributable to this remarkable change in the factory operatives.

Year.	Population.	Foreign.
1836	17,633	2,661
1844	25,163	2,864
1855	37,553	8,500
1865	30,990	9,422
1875	49,688	17,788
1879	53,000	19,000

The same fact is noticeable in all the leading manufacturing cities of the State. In Lawrence 45 per cent of the population are foreign born; in Holyoke 52, and in Fall River 53 per cent.

Manchester and Leeds (England) have their resident operatives, a dependent factory caste—once in the factory, seldom or never a door is found open for escape. In the mills of Lowell the operatives are constantly changing. This has been so from the start, and from the nature of things must always continue. Manufacturing began here by drawing from the very best class of New England young men and girls, who remained until better chances offered elsewhere, others taking their places, and like them used the mills only as stepping stones to something better.

Surely there is nothing in the employment itself that debases, as the fifty years' history of the best mills of New England proves. It is a fact, that however low and sluggish new comers may be, close contact with active, hopeful life inspires in them new hope and new life. Those who are in the mills to-day are not expected to remain a single day after they have found a pursuit more profitable or better suited to their tastes. Our country is a wide one; all nationalities are welcomed, with choice of pursuit open alike to every individual, each taking the place he is best fitted to fill.

The Window Glass Trade.

Replies to a circular of inquiry, sent out by the President of the Window Glass Manufacturers' Association, show that with 68 furnaces and 569 pots devoted to window glass, there are, or soon will be, in operation 546 pots, distributed as follows: New York and Massachusetts, 11 furnaces, 70 pots; New Jersey and Eastern Pennsylvania, 13 furnaces, 104 pots; Baltimore, 5 furnaces, 34 pots; Pittsburg, 21 furnaces, 192 pots; the Western States, 18 furnaces, with 146 pots. Last year there were made 1,463,807 boxes of window glass, a falling off from the output of the preceding year of nearly a hundred thousand boxes. There are 62 more pots running this year than last year.

The Elevated Railway Nuisance.

In New York city, a few days ago, while a truck loaded with cotton was passing through one of the main streets, now occupied by the elevated railway, a spark from a passing locomotive set fire to the cotton. An alarm was given, the fire engines came and extinguished the flames. Many cases of fires, caused by the elevated railway locomotives, have occurred.

© 1879 SCIENTIFIC AMERICAN, INC

A RECENT STUDY OF MEXICAN EARTHQUAKES.

"*Estudio del Terremoto del* 17 *de Mayo de* 1879." In a pamphlet with this title, sent us recently by Professor Mariano Bárcena, the learned Director of the Central Meteorological Observatory of Mexico, the author makes a truly valuable and interesting contribution to the science of seismatology in the form of a study of the earthquake which took place in the Mexican Republic on the 17th of May of the present year. This earthquake, the author tells us, like the one that preceded it in January, made itself felt in the valley of Mexico by a tremulous movement, principally a light one, although in other localities its action was more violent. In both January and May the areas affected were included within nearly equal limits having about the same situation, thus demonstrating the persistence and localization of volcanic forces in the eastern region of the republic. The most determinate forms of the movement were two—a tremulous and an undulatory. In many localities the first of these was the only one perceived, while in others an oscillatory motion succeeded in a direction about northeast to southwest. In Orizaba the earthquake ended with three vertical jerking movements and a circular one. The phenomenon, which varied in duration from four to forty seconds, was accompanied by subterranean noises in Orizaba, Vera Cruz, Alvardo, Acayucan, and San Nicolas.

Although in localization the earthquakes of January and May were about identical, they were not thus in intensity and consequently in effects. That of January did no damage, while the one of May was disastrous in its effects, and caused the ruin of many dwellings and public buildings in Orizaba, Cordoba, and other localities. In his study of the January earthquake the author endeavored by the graphic method to establish the focus of seismic action, and deduced the conclusion that it was found toward the south of Puebla, corresponding with the galleries of the volcanoes Citlaltepetl and Popocatepetl, and perhaps related to those of Tuxtla and Toluca. By a like study he reaches the conclusion that, during the May disturbance, the seismic manifestations were most notable in the southern part of Citlaltepetl, in the vicinity of Orizaba.

The comparison instituted by Professor Bárcena, in this study, between these two earthquakes strengthens the conviction that he has heretofore announced concerning the transitions and localizations that have occurred in seismic action during the last nine years. This action, very curiously, moves from one locality to another, fixing itself at certain points, where, so to speak, it quarters itself for an indefinite period; its manifestations decrease, and then it passes over to another region. Thus it has shown itself in the western zone, where it remained till relieved by the craters of Colima and Ceboruco; it made a short residence in Michoacan; passed over to Guanajuanto, where it also was permanent for a time; then turned toward Jalisco; and, from the beginning of the present year, this volcanic force has been found located in the eastern part of the country. The author repeats these particulars, which he has pointed out in a preceding study, because their repetition permits him to establish this new phase of seismic phenomena, not sufficiently noted perhaps by observers, and that is the transitory movements and prolonged residences just mentioned. The centers that the seismic activity has successively occupied are seven, and these are given in detail as a system of classification for future study.

Viewed in the light of the facts here given, the question may throw some light on the details of the subterranean topography, so to speak, of Humboldt's seismic zone. "In fact," says the author, "in mapping out the dynamic zone I do not conceive of it as a great gallery, regular in its dimensions, but an association of tortuous conduits, united by ganglions situated at different levels, affecting a system like that of more or less ramified veins and containing bunches or masses of ores." The seven foci cited "would be immense vacant spaces communicating with each other by galleries of different forms; in these the lavas and aqueous vapors exercise their pressure, and in many cases the secondary conduits are not sufficient to allow an exit to all of the gases that are produced in these central laboratories. If, as supposed by a modern theory, there are waters infiltrated, which, becoming converted into steam, disturb the terrestrial crust, it may well be conceived that the seismic phenomena became stationary until the work terminates in these immense gas generators."

In conclusion, the author cites some meteorological facts that go to sustain an observation previously made by him, and that is that earthquakes happen with greater frequency and with greater intensity after those years in which rains have been very prevalent.

Pliocene Man in California.

The evidences of the human occupation of the Pacific coast in preglacial times, as found in the gold bearing gravels of Sierra Nevada and California, embrace both stone implements and human bones. The superintendent of the California Geological Survey says, in a report on these gravels, that stone implements including tools, pestles, mortars, platters, spear and arrow heads, etc.) have been found in so many places that the fact of their occurrence in the gold gravels cannot be doubted. They have been found in the following localities: In Mariposa County, at Horse Shoe Bend, on the Merced River, at Hornitos, and five miles northeast and near Princeton; in Merced County, near Snelling; in Stanislaus County, at Dry Creek; in Tuolumne County, at Table Mountain, Kincaid Flat, Wood's Creek, Mormon Creek; in Amador County, near Jackson; in El Dorado County, at Shingle Springs, Diamond Springs near Placerville, Spanish Flat, Kelsey's Diggings, Dry Creek, Coloma, Georgetown, Brownsville; in Placer County, near Gold Hill, Forest Hill, Byrd's Valley, Missouri Tunnel; in Nevada County, at Grass Valley, Myer's Ravine, Brush Creek; in Butte County, at Cherokee; also in Siskiyou and Trinity Counties, localities not mentioned.

Human bones are reported from Tuolumne and Calaveras Counties.

(1) Under Table Mountain, Tuolumne County, a human jaw, obtained by Dr. Snell; same locality, in the Sonora Tunnel, at a depth of 180 feet, a portion of a skull, given to C. F. Winslow in 1857, by P. K. Hubbs, of Vallejo, Cal., the finder, and by the former noticed in the Proceedings of the Boston Society of Natural History, for October 7, 1857, the same locality affording also a mastodon's tooth and a "large stone bead" of white marble. Mr. Winslow also says that Captain D. B. Akey related to him a discovery of a complete human skeleton from a tunnel under Table Mountain, but stated that he did not remember the tunnel, and the fact has not been verified.

(2) In Calaveras County, in February, 1866, in the claim of Messrs. Mattison & Co., on Bald Mountain, near Altaville and Angel's, beneath the lava, from a depth of 130 feet. This is the skull which came into Professor Whitney's hands through Dr. Jones, who received it from Mr. Mattison, and which has been described by Dr. Jeffries Wyman. The material in which it had been embedded was mixed tufa and gravel, and attached to it was a specimen of *Helix mormonum*, a species now living in Nevada. According to Mr. Mattison, the succession of beds passed through from above to that containing the skull was: black lava, 40 feet; next below, gravel, 3; light lava, 30; gravel, 5; light lava, 15; gravel, 25; dark brown lava, 9; gravel (that containing the skull), 5. This bed rested on red lava, 4 feet, and red gravel, 17 feet. Professor Whitney brings forward the testimony of Mr. Scribner and also of Dr. Jones, and says: "We have the independent testimony of three witnesses, two of whom were previously known to the writer as men of intelligence and veracity, while in regard to the third there is no reason for doubting his truthfulness. Each one of these gentlemen testifies to some points in the chain of circumstantial evidence going to prove the genuineness of the find. No motive for deception on the part of Mr. Mattison can be discovered, while the appearance of the skull itself bears strong though silent testimony to the correctness of the story."

Dr. Wyman's report, as is now well known, stated that the "skull presents no signs of having belonged to an inferior race. In its breadth it agrees with the other crania from California, except those of the Diggers, but surpasses them in the other particulars in which comparisons have been made. This is especially apparent in the greater prominence of the forehead and the capacity of its chamber. In so far as it differs in dimensions from the other crania from California, it approaches the Esquimaux." The following are the comparisons above referred to by Dr. Wyman, the measurements being in millimeters:

	Breadth of Cranium.	Breadth of Frontal.	Frontal Arch.	Length of Frontal.	Height of Cranium.	Zygomatic Diameter.
22 Esquimaux	134·5	94	296·5	126·6	135	137·6
5 from Alaska	133·5	92·8	285·5	121·8	129·5	132
11 from differentparts of Cal.	150·5	93·5	260	117	120·8	134
3 Digger Indians	136·6	88·3	280	119	120·3	141·5
The fossil skull	150	101	300	128	134	145

Professor Whitney regards the gravels as preglacial and pliocene, on the basis of the evidence from the fossils found in them.

The Compressed Air Torpedo.

The cigar-shaped fish torpedo gets its motion from compressed air stored inside, and this, issuing at the tail, sets in motion a screw which revolves with considerable velocity. A well constructed fish torpedo will run many hundred yards at a velocity of twenty miles an hour, and on striking its head, which contains the charge, explodes with considerable violence. The fish torpedo is, therefore, a weapon of terrible effect.

A New Stereotype Composition.

This is known as Jannin's cement, from the name of the patentee, a resident of Paris. The cement is simply a mixture, in suitable proportions, of yellow oxide of lead (the quality known as massicot being preferable) with glycerine. Several other metallic oxides and matters may be mixed with the cement, so as to suit the quality or the color of the cement to the nature of the work to be produced, but the two essential compounds are yellow oxide of lead and glycerine. The proportions of oxide of lead and glycerine vary according to the consistency of the cement it is desired to produce. The proportion of glycerine will of course be larger for a very soft cement than for a stiff cement; it is not necessary, therefore, to specify the exact proportion of each of the two essential compounds.

This cement is specially adapted for moulding those objects which require an extreme delicacy in the lines of the cast, such as engraved blocks and plates, forms of printing type, photoglyptic plates, etc. Under the influence of gentle heat it sets in a few minutes, and then resists perfectly both pressure and heat. When set, it is also a very good substitute for natural lithographic stones, and it can replace them for many practical purposes. It can also be used for artistic reproductions, such as *facsimiles* of terra cotta, whose color and sonorous quality it possesses. Though setting to great hardness in a few minutes it does not shrink. Massicot, it may be observed, is an old name for litharge, but the term is more generally applied to the yellow oxide of lead, prepared from the scum of the molten metal by roasting until the color is fully developed. For purposes in which the color is of no moment, the scum itself would doubtless answer, provided it is thoroughly oxidized.

The Aurora Borealis.

The following letter, by Mr. G T. Temple, appears in the recent "Proceedings of the Royal Geographical Society:"

"Although the conjecture hazarded more than 160 years since by Halley, that the aurora borealis was a magnetic phenomenon, has acquired empirical certainty from Faraday's discovery of the evolution of light by magnetic forces, as well as from more recent observations, the following extracts, translated from a letter written by Herr Pastor emeritus H. M. F. Esmark, may perhaps be considered interesting, Herr Esmark having observed the meteorological conditions attending the display of the polar lights for many successive years: 'The aurora is neither seen during extreme cold or northerly winds, but appears when an ordinary arctic temperature is raised by southerly and westerly winds, and is generally followed by snow. In the southeastern part of Norway it seems to be especially caused by southeasterly winds, which are there very moist and rather warm. Its appearance is always accompanied by a falling barometer. In my opinion the phenomenon is due to the following causes: When a wind laden with warmth, moisture, and electricity comes in contact with a body of cold air, the moisture is converted into snow, the warmth and electricity are thereby released, and the aurora is the result of the disturbances. The northern lights cannot occur in very high latitudes, because the warm, moist air is cooled long before it reaches them.' In this way Herr Esmark would account for the splendid appearance of the aurora in Northern Norway, where the sea winds, bringing warmth, moisture, and electricity from the ocean, are met by cold land winds from the interior. MM. Lottin, Bravais, and Siljerström, who spent a winter at Bosekop, in Alten (lat. 70° N.), saw the northern lights 160 times in 210 nights. The most vivid aurora that I ever saw near Alten was toward midnight of the 12th of November, 1874. The flickering lights played about the masthead so like lightning that it was difficult to believe they were harmless. We had no snow, however, till the evening of the 14th, as we were entering Tromsöe Harbor, and during the discharges of light the compass needle was wildly erratic. The determination of the chemical elements involved by means of spectrum analysis is by no means the least of the numerous scientific results to be derived from Arctic exploration."

Advice to Professional Men.

To professional men, men of business, and, indeed, all who are engaged in pursuits requiring more or less severe mental work, coupled with more or less confinement, exercise is, of course, the *conditio sine qua non* of the recreation to be recommended. The fact is so obvious (says a writer in the *Nineteenth Century*) that I need not dwell upon it further than to make one remark. This is to warn all such persons that feelings are no safe guide as to the amount of muscular exercise that is requisite for maintaining full and sustained health. By habitual neglect of sufficient exercise, the system may, and does, accommodate itself to such neglect; so that not only may the desire for exercise cease to be a fair measure of its need, but positive exhaustion may attend a much less amount of exercise than is necessary to long continuance of sound health. However strong and well, therefore, a man may feel notwithstanding his neglect of exercise, he ought to remember that he is playing a most dangerous game, and that sooner or later his sin will find him out—either in the form of dyspepsia, liver, kidney, or other disease, which so surely creep upon the offender against nature's laws of health. According to Dr. Parkes the amount of exercise that a healthy man ought to take without fatigue is at the least that which is required for raising 150 foot-tons per diem. This, in mere walking, would, in the case of a man of ordinary weight, be represented by a walk of between eight and nine miles along level ground, or one mile up a tolerably steep hill; but it is desirable that the requisite amount of exercise should be obtained without throwing all the work upon one set of muscles. For this reason walking ought to be varied with rowing, riding, active games, and, where practicable, hunting or shooting, which, to those who are fond of sport, constitute the most perfect form of recreative exercise.

Copying Architectural Designs.

In Philadelphia the other day an architect applied to the courts for an injunction to restrain a builder from copying an original design for a porch on two houses erected in 1876. The preliminary injunction was dissolved, because the architect had neglected to have his design patented. It appeared that an exact copy was being made of a portico that gave distinctive character to two prominent houses, and the design of which was valuable on that account. It was, of course, an unpleasant thing for the owner to have this design literally copied, but he had neglected to secure for himself legal protection which the patent laws would have given him.

© 1879 SCIENTIFIC AMERICAN, INC

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

EXTRACT FROM COPY.

POST OFFICE DEPARTMENT,
Office of the 1st Asst. P. M. General,
WASHINGTON, D. C., Oct. 21st, 1879.

POSTMASTER.
Rahway, N. J.

SIR:

Complaint has been made that you are withholding letters addressed to M. A. Dauphin.

The simple fact that a letter is addressed to M. A. Dauphin does not, under the present ruling of the Department, warrant its detention at the mailing office.

Very respectfully,
(Signed) JAMES H. MARR,
1st Asst. P. M. General.

Thomas D. Stetson, 23 Murray St., New York, serves as Expert in Patent Suits.

Engines repaired without loss of time. L. B. Flanders Machine Works, Philadelphia, Pa.

Blake's Belt Studs. The strongest, cheapest, and best fastening for all belts. Greene, Tweed & Co., New York.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box423, Pottsville, Pa. See p. 285.

For Reliable Emery Wheels and Machines, address The Lehigh Valley Emery Wheel Co., Weissport, Pa.

Planing and Matching Machines, Band and Scroll Saws, Universal Wood-workers, Universal Hand Jointers, Shaping, Sand-papering Machines, etc., manuf'd by Bentel, Margedant & Co., Hamilton, Ohio. "Illustrated History of Progress made in Wood-working Machinery," sent free.

Drawing Instruments. G.S. Woolman, 116 Fulton St., N.Y.

Rubber Belting, Packing, Hose, and all kinds of manufacturers' supplies. Greene, Tweed & Co., 18 Park Pl., N.Y.

The Baker Blower ventilates silver mines 2,000 feet deep. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Carbon Plates. 48 Railroad Ave., Jersey City, N. J.

Fairbanks' Scales.—During the week ending 18th of October, 1,635 scales were shipped from the factory at St. Johnsbury, Vt., leaving then unfilled orders for nearly three thousand scales. The Messrs. Fairbanks are running their factory evenings, and are melting 22 tons of iron daily.

For Sale, very low.—24 dismounted 20lb. Parrott Guns, in good order. "Relics of the late war." Suitable for corner posts or ornaments for parks or cemeteries. Address R. W. Dugan, No. 323 N. 3d St., St. Louis, Mo.

Circular Saw Tables. P. Pryibil, 467 W. 40th St., N. Y.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

Park Benjamin's Expert Office, Box 1009, N. Y. Recipes and information on all industrial processes.

Jig Saw Machines. P. Pryibil, 467 W. 40th St., N. Y.

For Pulley Blocks, write Block Works, Lockport, N. Y.

Patent Steam Boiler Damper Regulator; most reliable and sensitive made. National Iron Works, New Brunswick, N. J.

One inch in thickness of H. W. Johns' Asbestos Cement Filling, applied to hot air and steam pipes, boilers, etc., is equal in effectiveness as a non-conductor of heat to double the quantity of any other cements or filling. Be sure and get the genuine. H. W. Johns Manufacturing Company, sole manufacturers, 87 Maiden Lane.

To stop leaks in boiler tubes, use Quinn's Patent Ferrules. Address S. M. Co., So. Newmarket, N. H.

To Capitalists, Steam Fitters, Founders, etc.—Patent right for sale of new Steam Heat Radiator. Address, for particulars, J. N. Farnham, Waltham, Mass.

Books on Applied Science. Catalogue free. E. & F. N. Spon, 446 Broome St., New York.

Steam Traps; best and cheapest in use. No blowing through to start. T. Sault, New Haven, Conn.

Brass or Iron Gears; list free. G. B. Grant, Boston.

The Friction Clutch that is doing work in many places satisfactorily, that has never been done by any other, can be seen at Institute Fair, New York. D. Frisbie & Co., New Haven, Conn.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

The Secret Key to Health.—The Science of Life, or Self-Preservation. 300 pages. Price, only $1. Contains fifty valuable prescriptions, either one of which is worth more than ten times the price of the book. Illustrated sample sent on receipt of 6 cents for postage. Address Dr. W. H. Parker, 4 Bulfinch St., Boston, Mass.

The Baker Blower runs the largest sand blast in the world. Wilbraham Bros., 2318 Frankford Ave., Phila., Pa.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Steam Excavators. J. Souther & Co., 12 P.O. Sq. Boston.

Bradley's cushioned helve hammers. See illus. ad. p. 302.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Band Saws a specialty. F. H. Clement, Rochester, N.Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

The New Economizer, the only Agricultural Engine with return flue boiler in use. See adv. of Porter Mfg. Co., page 270.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 269.

Silent Injector, Blower, and Exhauster. See adv. p. 302.

Portable Railroad Sugar Mills, Engines and Boilers. Atlantic Steam Engine Works, Brooklyn, N. Y.

Machine Diamonds. J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Steam Heat. Appa. Superior construction. See illustrated ad. p. 269.

Cut Gears for Models, etc. (list free). Models, working machinery, experimental work, tools, etc., to order. D. Gilbert & Son, 212 Chester St., Philadelphia, Pa.

Millstone Dressing Machine. See adv., page 301.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

The E. Horton & Son Co., Windsor Locks, Conn., manufacture the Sweetland Improved Horton Chuck.

Pays well on small investments; Magic Lanterns and Stereopticons of all kinds and prices; views illustrating every subject for *public exhibition and parlor entertainments*. Send stamp for 80 page Illustrated Catalogue. Centennial medal. McAllister, 49 Nassau St., New York.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Fleetwood and Dexter Scroll Saws, Tool Chests, etc. Send for circular. Jas. T. Pratt & Co., 53 Fulton St., N. Y.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) S. R. R. F. asks for a receipt for liquid glue, suitable for wood, bracket saw work, etc., requiring no heat when to be used. A. Dissolve best glue in warm acetic acid, *q. s.* See p. 2510, No. 157, SCIENTIFIC AMERICAN SUPPLEMENT.

(2) M. P. H. asks: What is crystallized sulphydrate of sodium? Does it not go by some other name? A. Commonly called sulphide of soda, cryst. (purified).

(3) T. B. asks: 1. What will toughen white wax for flower making, at the same time look clean and transparent? A. Fuse the wax with about 5 per cent of pale amber or gum copal. 2. Will spirits of wine melt salmon skin, or the isinglass that is sold for clearing coffee, and would it mix with the wax afterwards? Do you think that would answer, or is there something else better and inexpensive? A. Yes, if somewhat diluted with water and warmed. It would not mix with the wax as you suggest.

(4) J. C. asks: Can you inform me of any substance that could be put on a wood surface, 4×8 feet, rendering the surface perfectly smooth and impervious to water, that would not wear much with the continual flow of stamped (crushed) quartz ore over it? I want to use it on a concentration table. A. Plate glass might satisfy your requirements. We know of no coating likely to withstand the wear.

(5) N. D. G. asks: Couldn't you give some more common name or recipe for the ink used with composition pad described in a recent number of the SCIENTIFIC AMERICAN? A. Use a nearly saturated aqueous solution of a good aniline blue or violet. Ordinary copying ink will not answer.

(6) J. A. N. writes: I want a clear phosphorus solution, say one half pint of spirits of wine to contain 1-20 of its parts of phosphorus, it must not contain any greasy substance, but be perfectly clear. Will you give me a receipt, and what time will it take before it will be ready for use? A. Phosphorus is very soluble in carbonic sulphide, and to some extent also in ether. It cannot be dissolved in spirits of wine, as proposed. The liquid solvents above mentioned are quite volatile; the phosphorus remaining after the liquid has evaporated is in so finely divided a condition as to inflame spontaneously on contact with air; great caution must, therefore, be observed in handling them to avoid accident.

(7) M. H. C. asks for a recipe for starching linen wear so as to produce a high polish. A. Use a good corn starch paste, well rubbed in; moisten (sponge) lightly with solution of 3 parts egg albumen and 1 part of gum arabic, dissolved in 5 parts strong ammonia water and 2 parts soft cold water, before ironing. The perfection of gloss is only developed by heavy pressure and friction.

(8) C. W. G. writes: 1. I have several lamb skins with the wool on, which I have dried in the sun with alum and salt, but the skins are hard. What can I do to soften them? They have been washed thoroughly. A. Remove all fragments of flesh with the knife, with care not to cut or bruise the inner skin; dry with towels, lay the skin flat on a board, and scrub the flesh side thoroughly with a stiff brush, soft soap, and hot water. Then sprinkle and scrub it with 2 oz. of cream of tartar, and 1 oz. ammonia, and dry with sawdust; when dry soak it for 2 days in the following pickle: 1 lb. oatmeal, 8 oz. corrosive sublimate (mercuric chloride), 4 oz. saltpeter, and 1 gall. vinegar; stir and dissolve in the hot vinegar and cool before using. When taken out of the pickle strain it tightly over a stretcher until quite dry—(which usually requires about a week). Comb out the wool while drying. 2. I have several articles of stamped tinware that need new tinning, nothing being worn except the tin. Can you tell me a good way to retin, so that they can be used for cooking? A. Better discard them and purchase new ones.

(9) C. F. S. asks: What can I do with a cedar water bucket to keep water from tasting? A. Scour it occasionally and rinse with solution of sodium sulphite.

(10) J. M. H. asks what to do with a stovepipe used through the winter with base burner coal stove, to make it last, for it spoils through the summer, and I am obliged to get a new set of pipe every fall. Would I do better to get galvanized iron pipe, or can I coat it on the inside with anything to protect it? A. The remedy is to use a better anthracite fuel, or to cap your chimney with a weather cap—probably the latter. Painting or galvanizing is useless. See that you get good planished iron in your pipe, clean out the soot, and keep in a dry place when not in use.

(11) D. L. D. asks for a receipt for the cure of sumac poison. A. Salt water and diluted ammonia are commonly used. Sulphate of zinc and glycerine has also been used (externally of course) with success.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

E. B. B.—Teeth of No. 1, *Oxyrhina desorii*, No. 2, *Elephas Americanus*, and No. 3, Ichthyosaure. Two specimens in unlabeled needle box: No. 1, chalcopyrite, No. 2, ferruginous clay, No. 3, marcasite.—M. F. C.—It is a variety of infusorial earth. See p. 240, Vol. 35. No. 2 is a micaceous sand from decomposed and disintegrated granitiferous rock. It contains nothing of value. Other than the attraction of gravitation, which acts alike between all bodies, there exists no attractive influence between the metals and peach tree limbs (or limbs of other trees). The divining rod is not a scientific instrument, and aside from its employment in sensational tales, its wonderful attributes, like those of the philosopher's stone, are merely delusive fancies.—F. S.'s and P. P. G.'s minerals have not been received.—J. F. Y.—No. 1 is coral replaced by silex; No. 2 is encrinite; No. 3 is cyathyphylloid coral; No. 4 is millepore coral, and No. 5 an imperfect fossil.—W. H. H.—It contains 85 per cent of metallic lead, and will pay to mine if there is enough of it.—T. H. A.—It is fibrous steatite, soapstone.—P. G.—No. 1 is quartzite; No. 2, ferruginous quartz. We do not find the other specimen spoken of in your letter.—S. A. L.—It consists of heavy spar or sulphate of barytes with oxide of iron. The former is used for adulterating white lead.—J. A. B.—It is quartz rock, possibly auriferous. A careful assay would be required to determine this.—W. H. G.—There are many localities in the United States where specimens of tin ore are found, but no genuine tin mines. Tin is usually associated with fluor, apatite, topaz, blendes, wolfram, etc. The present price of tin in New York is from 22 to 24 cents per pound.

COMMUNICATION RECEIVED.

On an Early Blooming Apple Tree. By E. A. M.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 14, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Aerobat, J. J. Greenough 220,473
Air exhaust apparatus, J. Murphin 220,641
Automatic brakes, regulating valve for, G. Westinghouse, Jr. 220,556
Axle lubricator, vehicle, J. V. Hinkle 220,617
Bale band bender, L. Miller 220,636
Bale band tightener, L. Miller 220,635
Bale band tying machine, Matthews & Morehead 220,541
Barrels, etc., with liquids, apparatus for filling, Trautmann & Humphreys 220,509
Bed bottom, spring, L. Wildermuth 220,557
Beer and liquor protector, T. A. Stephan 220,679
Belts or bands, apparatus for testing strain of, J. H. Sawyer 220,668
Billiard cue coloring apparatus, A. Fitzgerald 220,596
Blasting powder, O. B. Hardy 220,534
Bolt heading machine, C. D. Rogers 220,497
Boot and shoe, W. H. Hannaford 220,475
Boot and shoe cleaning and polishing machine, J. T. Schultz 220,671
Boot and shoe, machine sewed, G. W. Day 220,583
Boot and shoe uppers, machinery for lasting, J. W. Hatch (r) 8,927
Bracelet, C. Hein (r) 8,928
Bristles for dyeing, preparing, T. Dost 220,468
Button and stud, A. C. Greene 220,531
Caddy, spice, W. B. Hartley 220,609
Car coupling, M. G. McCarty 220,486
Car coupling, H. T. Rook 220,663
Car coupling, L. Spain 220,678
Car ventilator, C. E. Lucas 220,628
Carboy, Seymour & Thomas 220,499
Carbureting apparatus, J. Weart 220,685
Carriage step, F. A. Sawyer, 2d 220,666, 220,667
Carriage top prop, H. K. Porter 220,493
Cartridge belt and holder, E. Schaub 220,550
Cartridge primers, anvil for, J. H. Gill 220,472
Caster, sewing machine, J. O Sloan 220,673
Chain hook, J. E. Studley 220,506
Churn, T. C. Harris 220,611
Churning machine, J. T. Haile 220,474
Cigar box, J. Casey 220,575
Clock, alarm, H. Loriot 220,540
Clutch and brake, friction, W. R. Havens 220,613
Cockle separator, P. M. L. Herse 220,477
Collar frames, die for forming metallic horse, E. Fisher 220,594
Cotton picker, hand, T. W. Ham 220,607
Cuff, J. H. Buss 220,519, 220,573
Cultivator W. P. Brown 220,463, 220,571
Dental foil package, R. S. Williams 220,687
Desk, school, J. W. Childs 220,466
Dog power, E. Glendillen 220,603
Doll supporter, J. S. Goye 220,606
Doors, angle plate for, R. C. Morris 220,489
Dough mixer, C. A. Wolff 220,690
Drain and other pipes, J. P. Culver 220,522
Dress adjuster, E. Ebner 220,588
Dye, compound, G. Molt 220,638
Eave trough iron, W. H. & L. Berger 220,515
Electric train signaler, J. C. E. Ohlenschlager 220,647
Envelope, H. B. Maxwell 220,485
Fare box for street cars, H. R. Robbins 220,661
Farm gate, G Johnson 220,623
Faucet, self-closing, W. I. Page 220,652
Feed water heater, J. Argall 220,563
Fence, portable, A. J. Truxell 220,683
Filter press, A. Wegelin 220,686
Fire alarm and fire extinguisher, combined, J. W. Smith 220,674
Firearm, breech-loading, J. Peightal 220,655
Firearm, breech-loading, J. Purdey 220,657
Fire engine, E. Glendillen 220,604
Fire lighter, H. B. Malone 220,484
Fireplace heater, G. W. Hiller 220,615
Fish plate and railway chair, J. D. Shoots 220,672
Flour, machine for making, W. D. Leavitt 220,626
Fluting machine, J. E. Donovan 220,586
Fruit package, Newell & Van Gorder 220,543
Galvanic battery cell, Thomson & Houston 220,507
Gas burner, atmospheric, A. W. Morton 220,490
Gas generator and burner, A. E. Watkins 220,554
Gas regulating burner, J. W. Cloud 220,577
Gate, E. Robins 220,662
Globe holder for gas fixtures, H. B. Stillman 220,504
Globe, time, J. Arkell 220,462
Globe, time, L. P. Juvet 220,480
Gold washer, W. H. Pilliner 220,656
Governor, steam engine, F. W. Robinson 220,660
Grain binders, knot tier for, O. O. Storle 220,551
Grain separater, J. W. Morrison 220,639
Grate, E. Card 220,464
Grinding mill for tortilla, green corn, etc., F. A. Gardner 220,525
Grub or sprout extractor, J. W. Snapp 220,501
Gun, machine, H. Palmerantz 220,545
Hair, treating non-feltable animal, G. Hamilton 220,532
Hair, treatment of animal, G. Hamilton 220,533
Hair weft, J. R. Krause 220,627
Halter, S. Scott 220,498
Hat band, ornamental, M. Goldberg 220,605
Hats and caps, machine for producing brims on sweat bands for, T. W. Bracher 220,570
Heel, revolving, Massey & Spencer 220,629
Hoes, rakes, etc., detachable handle for, Howell & Wienges 220,618
Horse creeper, J. Forsyth 220,597
Horse toe weight, E. W. Noyes 220,646
Horseshoe, C. J. Carr (r) 8,932
Horseshoe toe weight, S. T. Bane (r) 8,931
Ice elevator, C. J Atkins 220,564
Injector and ejector, combined, L. B. Fulton 220,471
Ink fountain for printing machines, G. W. Prouty 220,547
Interfering strap, C. B. Dickinson 220,585
Jar for preserving fruits, etc., J. Murphin 220,642
King bolt, clip, H. K. Porter 220,495
Kitchen boilers, attachment for, L. Brandeis 220,517
Knife for cutting hay and cane, H. Fisher 220,469
Lamp, extension, L. Hornberger 220,535
Lamp miner's, J. O. Davies *et al.* 220,582
Lamp regulator, electric, Thomson & Houston 220,508
Levers, crank arms, etc., self-locking and releasing attachment for, O. O. Storle 220,552
Lift, hydro-pneumatic, Johnson & Bailey 220,479
Lime kilns, draught apparatus for, H. Horst 220,478
Locomotive and other furnaces, H. F. Hayden 220,614
Locomotive main and coupling rod, Crawford & Laird 220,467
Loom, J. D. Cottrell 220,579
Loom shuttle, Roberts & Lyons 220,659
Malt kiln floor, F. W. Wolf 220,513
Marker, land, S. Ryan (r) 8,935
Metal bending machine, E. W. Stewart 220,503
Middlings purifier, L. Gathmann (r) 8,929
Milk, machine for creaming, H. F. Bond 220,516
Millstone driver, R. S. Cathcart (r) 8,933
Mustache guard, V. M. Law 220,538
Necktie, W. A. Laverty (r) 8,934
Neck wear pin, Hart & Gaither 220,610
Nut roaster, Winsor & Hall 220,689
Oatmeal machine, G. H. Cormack 220,578
Oil cabinet, J. M. Thayer 220,682
Oils, apparatus for vaporizing and burning hydrocarbon, J. A. Frey 220,470
Opera chair, folding, T. M. Foote 220,523
Optical instruments made of celluloid and other fibrous plastic compositions, frame for, J. S. Spencer 220,502
Padlock, F. W. Mix 220,637
Paper pouch, J. H. Weaver 220,510
Passenger gate, C. J. Jorgensen 220,624
Patterns to fabrics, transferring, R. Hudson *et al.* 220,619
Pen, fountain, C. Baur 220,568
Pen, fountain, H. Madeheim 220,483
Pencil attachment, J. W. McGill 220,632
Pencil, lead, J. E. Faber 220,591
Pill box, N. V. Randolph 220,658
Pillow block, adjustable, W. M. Mills 220,487
Pillow sham holder, adjustable, Smith & Fay 220,675

© 1879 SCIENTIFIC AMERICAN, INC

Planter and cultivator, W. C. Thompson	220,553
Planter, corn, J. F. Walker	220,684
Plow, G. Dodge (r)	8,926
Plow coiter attachment, H. & J. Oldendorph	220,650
Plow point, J. Oliver	220,649
Plow points, chill for chilling, J. Oliver	220,648
Plow, sulky, W. J. Meharry	220,633
Plow, wheel, W. Newlin	220,643
Pottery pipes, forming and bending, W. B. Hyde	220,536
Power transmitter, D. Abrey	220,560
Printing machines, inking apparatus for, J. H. Cranston	220,581
Printing on metal, surface for, J. M. Ronemous	220,549
Pulley block, J. L. Reed	220,548
Pump, I. D. Fegely	220,593
Pump and curb, chain, F. W. Devine	220,584
Pump, rotary, L. Chapman	220,520
Rake tooth, metallic, W. M. White	220,511
Riciprocating apparatus or motor, A. Knecht	220,625
Road engine, W. T. Hatch	220,612
Rolling pin, J. L. Scarborough	220,669
Rope way, elevated safety, J. S. Pierson	220,492
Sash, metallic window, H. A. Streeter	220,505
Saw, drag, Augspurger & Neimeyer	220,565
Saw gummer, Cass & Long	220,572
Sawing machine, horse power, B. T. Adams	220,561
Scarf, neck, H. W. Barry	220,567
Scoop and funnel, combined grocer's, W. S. Chilis	220,576
Screw cutting die, R. C. Fay	220,592
Screw cutting dies, plate for holding, J. G. Geiser	220,601
Screw machine, wood, T. O. Bennett	220,569
Seeding machine, C. O. Gardiner	220,536
Sewing machine attachment for lathes, J. W. Post	220,496
Sewing machine button hole attachment, G. F. Hildenbrand	220,616
Sewing maching motor, A. T. Hammer	220,608
Sheet metal vessel, R. C. Morris	220,488
Shroud block, O. E. Huss	220,621
Sifter, T. J. Mozart	220,640
Siphon, H. G. Whitaker	220,512
Slipper, convertible, A. S. Adler	220,562
Speed and leeway indicator, ship's, W. Huston	220,622
Spindle bands, device for indicating tension in the adjustment of, W. T. Draper	220,587
Sponge cup, H. Friedlander	220,600
Spooling machinery, thread, J. W. West	220,555
Spouts, funnel attachment to, Payne & Richards	220,653
Spring clasp, C. Strickrodt	220,680
Stamp, hand, Chamberlain & Marden	220,521
Stamp, rotary hand, J. F. Du Buigne	220,518
Staples, die for making stock bell, O. B. Wilson	220,558
Steam boilers, superheater for, H. Schaubel	220,670
Steam boilers, water supply and heater for, B. Ford	220,598
Steam brake, M. A. Lovell	220,482
Steam engines, connecting rod for, L. Skinner	220,500
Steam generator, J. E. Freeman	220,599
Stirrup loop, H. F. R. F. Somerset	220,677
Stove and furnace, W. A. Greene	220,530
Stove, parlor heating, W. A. Greene	220,529
Stoves, mica window and door for, W. A. Greene	220,528
Stud, shirt, G. H. Niles	220,491
Tackle block, J. W. Norcross	220,644, 220,645
Tap valve for barrels, M. G. Gillette	220,602
Tapping and venting barrels, etc., E. Fitch	220,595
Thread, apparatus for waxing, Chase & Sargent	220,465
Tire upsetting machine, C. W. Edelblute	220,589
Tobacco press, G. R. Payton	220,654
Toilet stand, J. Merlette, Jr	220,634
Tongs, hardening, B. Le Doyt	220,681
Tongue support, wagon, R. N. B. Kirkham	220,537
Traction engine, McGregor & Croxton	220,631
Tree protector, A. Loring	220,481
Tube expander and beader, O. Pagan	220,651
Vapor burner, W. H. Russell	220,665
Vehicle spring clip, C. W. Patten	220,546
Vehicle wheel, J. R. Baird (r)	8,930
Vinegar apparatus, S. Levy	220,539
Wagon body, extension, J. M. Rose	220,664
Wagon, dumping, A. McFarlane	220,630
Wagon seat fastener, O. Oakes	220,544
Washing machine, J. W. Estes	220,590
Washing machine, D. Fuller	220,524
Washing machine, Hull & Miller	220,620
Waste and sewer pipes, gas check for, W. Wilson	220,559
Water closet hopper, J. M. Wilson	220,688
Water tank, railway, J. D. Craig	220,580
Well tube and device for inserting the same, W. H. Burgess	220,572
Wells, device for extracting or splitting the tubular casings of oil, H. Harris	220,476
Wells, implement for grappling, withdrawing, and perforating pipes and tubes in artesian, B. F. Mull	220,542
Whiffletree coupling, H. K. Porter	220,494
Windmill, Woodmanse & Lebkicker	220,514
Wire cutter, J. Baker	220,566
Wire stretcher, M. Smith	220,676
Yeast compound, Goll & Spinner	220,527

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

60 New Styles Chromo and Floral Cards, in case, **10c.** **80** agts.' samples, **10c.** Stevens Bros., Northford, Ct.

An Elegant Holiday Present. A gilt-bound Autograph Album, with 48 beautifully engraved pages, also 47 select quotations, all for 15 cts., postpaid. P. O. stamps taken. Agts. wanted. Franklin Bros., West Haven, Ct.

A

FORTUNE QUICKLY MADE.

Money has been made more rapidly within the last few months in Wall Street than at any period since 1873. Immense profits have been realized from small investments. The following affidavit explains itself:

Personally appeared before me, George A. Payne, of 134 West 49th Street, New York city, to me known, and, on being duly sworn, says that on an investment of $25 placed with Thatcher, Belmont & Co., bankers, and by them operated for a period of two weeks, I had returned to me by the said firm $972.53.

(Signed) GEO. A. PAYNE.

State of New York, City and County of New York, } ss.

Sworn before me this 22d September, 1879.

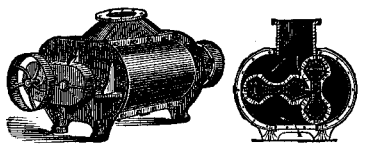
J. B. NONES, Notary Public, 91 Duane Street, N. Y.

Thatcher, Belmont & Co., accept subscribers on their 1 per cent. margin or in their concentration of capital, whereby a number of small sums, from $10 upwards, are aggregated and stocks operated. Latest Wall Street information sent free upon application by Messrs. Thatcher, Belmont & Co., Bankers, P. O. Box 1307, or 48 Broad Street, New York.

TO MECHANICS AND OTHERS.

A premium will be given for a Miniature Brick Making Machine, to make a brick one inch cube square, one ounce weight, one or more at a time, from a pigment slightly moist. A very good pressure indispensable. To work by treadle, water, or steam power, the former preferred. Address BLUE, P. O. Box 388, Halifax, N. S., Canada.

Roots' Positive Blast Blower.



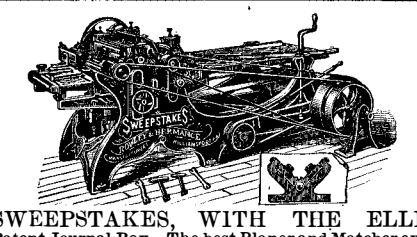
P. H. & F. M. ROOTS, M'f'rs, Connersville, Ind.

S. S. TOWNSEND, Gen. Agt., } 6 Cortlandt St.,
WM. COOKE, Selling Agent, } NEW YORK.

☞ SEND FOR PRICED CATALOGUE.

Harrison
SAFETY
BOILER.

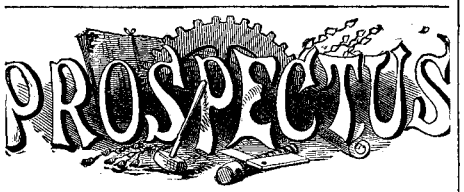
The **Most Durable** and **Best.** Over **60,000** horse power in use. Having purchased the special tools for manufacturing this Boiler from my father's estate, I am prepared to furnish parts of the Boiler, or receive orders for new work. W. H. HARRISON, 21 Courtland Street, Room 56, New York.



SWEEPSTAKES, WITH THE ELLIS Patent Journal Box. The best Planer and Matcher ever made. Planing 20 in. wide, 6 in. thick, weight 2,100 lbs., $900; planing 24 in. wide, 6 in. thick, weight 2,500 lbs., $350. Beading, Arbor, and Head, extra, $20. Sash, Door, and Blind Machinery a specialty. Send for descriptive catalogue to Rowley & Hermance, Williamsport, Pa.

80 Samples Photo, Duplex, etc. Cards, **10c.** Autograph Album, **13c.** GLOBE PRINT CO., Northford, Ct.

$777 A YEAR and expenses to agents. Outfit Free. Address P. O. VICKERY, Augusta, Maine.



OF THE

Scientific American

FOR 1879.

The Most Popular Scientific Paper in the World.

VOLUME XL.—NEW SERIES.

The publishers of the SCIENTIFIC AMERICAN beg to announce that on the Fourth day of January, 1879, a new volume will be commenced. It will continue to be the aim of the publishers to render the contents of the new volume as, or more, attractive and useful than any of its predecessors.

Only $3.20 a Year including Postage. Weekly. 52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information, and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc.

All Classes of Readers find in THE SCIENTIFIC AMERICAN a popular *resume* of the best scientific information of the day; and it is the aim of the publishers to present it in an attractive form, avoiding as much as possible abstruse terms. To every intelligent mind, this journal affords a constant supply of instructive reading. It is promotive of knowledge and progress in every community where it circulates.

Terms of Subscription.—One copy of THE SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States or Canada, on receipt of **three dollars and twenty cents** by the publishers; six months, $1.60; three months, $1.00.

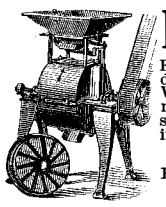
Clubs.—One extra copy of THE SCIENTIFIC AMERICAN will be supplied gratis *for every club of five subscribers* at $3.20 each; additional copies at same proportionate rate. Postage prepaid.

One copy of THE SCIENTIFIC AMERICAN and one copy of THE SCIENTIFIC AMERICAN SUPPLEMENT will be sent for one year, postage prepaid, to any subscriber in the United States or Canada, on receipt of *seven dollars* by the publishers.

The safest way to remit is by Postal Order, Draft, or Express. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO.,
37 Park Row, New York.

To Foreign Subscribers.—Under the facilities of the Postal Union, the SCIENTIFIC AMERICAN is now sent by post direct from New York, with regularity, to subscribers in Great Britain, India, Australia, and all other British colonies; to France, Austria, Belgium, Germany, Russia, and all other European States; Japan, Brazil, Mexico, and all States of Central and South America. Terms, when sent to foreign countries, Canada excepted, $4, gold, for SCIENTIFIC AMERICAN, 1 year; $9, gold, for both SCIENTIFIC AMERICAN and SUPPLEMENT for 1 year. This includes postage, which we pay. Remit by postal order or draft to order of Munn & Co., 37 Park Row, New York.



Portable Grain Mills,

For Mill and Farm. Built on the durable and scientific principles. Warranted fully equal to any in the market. Mills for grinding all substances. We have made mill building a specialty for 13 years.

WALKER BROS. & CO., Engineers, Founders & Machinists, 23d and Wood St., Phila., Pa.

Wanted, Second-Hand Machinery.

One 66 in. Planer, 20 ft. long.
One 36 in. Swing Lathe, 20 ft. long.
One 24 in. " " 14 or 16 ft. long.
One Punch and Shear to punch 26 or 36 in. from edge.

Must be in first-class order, and very cheap for cash. Apply, stating particulars, JAMES SHERIFFS, Cor. Barclay and South Water Sts., Milwaukee, Wis.

A patent right for the Eastern States on a Spoke Driving Machine. Most work of cast and malleable iron. Address LOUIS RAKOW, Gilbert, Kane County, Ill.

☞ For Improved Blind Staples and Drivers, Rod Cutters, Blind Stile Borers, address B. C. DAVIS, Binghamton, N. Y.

ARCHITECTURAL IRON WORKS

For Sale.—The Plant Machinery, Patterns, and good will. Located at one of the best manufacturing points between New York city and Chicago, in the best market for buying materials and shipping product. Terms made easy. Address IRON WORKS, Care Letter Carrier, No. 29, Cleveland, Ohio.

GEO. W. TIFFT, SONS & CO., BUFFALO, N. Y., Specialties 4 to 40 H. P. Engines and Boilers, Sugar Cooling Wagons, Machinery, Steam Kettles, etc.

CARY & MOEN STEEL WIRE OF EVERY DESCRIPTION & STEEL SPRINGS. 234 W. 29. ST. NEW YORK CITY.

PATENTS AT AUCTION

and at Private sale. Regular Monthly Sales. For terms, address N. Y. PATENT EXCHANGE, 67 Liberty Street, New York.

NIXON'S COPYING PAD.

A cheap, simple, and perfect method for the instant reproduction of 50 to 100 copies of any writing, drawing, etc. Electric Pen, Papyrograph, etc., completely outdone. Every one his own printer.

Post card size, 50c.; Note, 75c.; Letter, $1; Legal, $1.25, by mail, postage prepaid. Agents wanted.
ED. H. NIXON, 52 Maiden Lane, New York.

TELEPHONE.

Send for Circular of the Best Exchange Switch Board in the world. C. E. JONES & BRO., Cincinnati, Ohio.

To Electro-Platers.

BATTERIES, CHEMICALS, AND MATERIALS, in sets or single, with Books of Instruction for Gold, Silver, or Nickel Plating. THOMAS HALL, Manufacturing Electrician, 19 Bloomfield Street, Boston, Mass. Illustrated Catalogue sent free.

IMPROVED DOOR BRACE.

Patented October 21st, 1879. The most useful article of the age. Everybody should have it. Two dollars invested will save fifty dollars. The patentee has eight special good reasons to assert this fact. Everybody advised to purchase a right, for it is a good thing. Address

JOSEPH LOUPRETTE,
Glens Falls, N. Y.

PATENT SPARK-ARRESTER.
8 -H. P. Mounted, $650.
10 " " 750.
12 " " 1000.
2-H. P. Eureka, $150.
4 " " 250.
6 " " 350.

Send for our Circulars.

B. W. Payne & Sons, Corning, N. Y.
State where you saw this.

A. J. WILKINSON & CO.,

184 to 188 Washington St., Boston,

Machinists' Tools

CUT BRASS GEARS.

Estimates promptly Furnished. Catalogues Mailed FREE.

THE DRIVEN WELL.

Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent,** leased by the year to responsible parties, by

WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

50 Brilliant, Chromo, and Tortoise Shell Cards, in case, with name, 10c. Outfit, 10c. HALL BROS., Northford, Ct.

WATSONS NON CHANGEABLE GAP LATHE HAS GREAT FACILITIES FOR LARGE OR MEDIUM SIZE WORK JAMES WATSON MANR 1608 S. FRONT ST. PHILA. U.S.A.

ORGAN BEATTY PIANO

New ORGANS 13 Stops, 3 set Golden Tongue Reeds, 5 Oct's, 2 Knee Swells, Walnut Case, warr't'd 6 years, Stool & Book $98. New Pianos, $143 to $255. ☞ Newspapers Free. Address Daniel F. Beatty, Washington, New Jersey.

Bookwalter Engine.

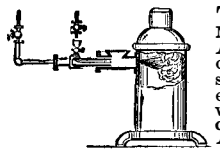
Compact, Substantial, Economical, and easily managed; guaranteed to work well and give full power claimed. Engine and Boiler complete, including Governor, Pump, etc., at the low price of

3 HORSE POWER.....$215 00
4½ " " 245 00
6½ " " 315 00

☞ Put on cars at Springfield, O.
JAMES LEFFEL & CO., Springfield, Ohio.
or 110 Liberty St., New York.

DYKES' BEARD ELIXIR
A Wonderful Discovery. Forces heavy Moustache or Beard even on smooth faces in from 20 to 30 days. These cuts are from the original, and show a positive result from its use. It works like magic and never fails. No possible injury to the skin, easily applied and certain in effect. P'kg, post-paid 25cts. 3 for 50cts. L. L. SMITH & CO. Sole Ag'ts, Palatine, Ill. All others counterfeit.

60 Queen Anne and Photo Cards, illuminated and perfumed, in case, **10c.** GLOBE PRINT CO., Northford, Ct.



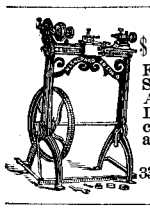
THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

ICE-BOATS — THEIR CONSTRUCTION

and management. With working drawings, details, and directions in full. Four engravings, showing mode of construction. Views of the two fastest ice-sailing boats used on the Hudson river in winter. By H. A. Horsfall, M.E. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **1.** The same number also contains the rules and regulations for the formation of ice-boat clubs, the sailing and management of ice-boats. Price 10 cents.

ICE-BOAT WHIFF.—FULL WORKING

drawings and description, with dimensions of the model ice-yacht Whiff, the fastest yacht in the world. Exhibited at the Centennial, by Irving Grinnell. With 14 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, **63.** Price 10 cents. To be had at this office and at all news stores. Any intelligent person, with the aid of the drawings and directions given in the above numbers of the SUPPLEMENT, may readily construct a first-class ice-boat, of any desired size, at a small cost.



SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.

Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.

H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street,
Cincinnati, Ohio.

The George Place Machinery Agency

Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.

SEND **10** CENTS IN U. S. POSTAGE STAMPS FOR Manual for Engineers and Steam Users, by John W. Hill, M.E., to WM. A. HARRIS, Providence, R. I.

Steel Stamps
N.Y. STENCIL WORKS, 87 Nassau St. N.Y.

PHOTOGRAPH VISITING CARDS. Send **10c.** for circular and 80 samples. SEAVY BROS., Northford, Ct.

CAVEATS, COPYRIGHTS, TRADE MARKS, ETC.

Messrs. Munn & Co., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine Improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had OVER THIRTY YEARS' EXPERIENCE, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the Prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Trade Mark Regulations, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very moderate terms.

We send free of charge, on application, a pamphlet containing further information about Patents and how to procure them; directions concerning Trade Marks, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases, Hints on the Sale of Patents, etc.

Foreign Patents.—We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing patents in all the principal countries of the world. American inventors should bear in mind that, as a general rule, any invention that is valuable to the patentee in this country is worth equally as much in England and some other foreign countries. Five patents—embracing Canadian, English, German, French, and Belgian—will secure to an inventor the exclusive monopoly to his discovery among about ONE HUNDRED AND FIFTY MILLIONS of the most intelligent people in the world. The facilities of business and steam communication are such that patents can be obtained abroad by our citizens almost as easily as at home. The expense to apply for an English patent is $75; German, $100; French, $100; Belgian, $100; Canadian, $50.

Copies of Patents.—Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at reasonable cost, the price depending upon the extent of drawings and length of specifications.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

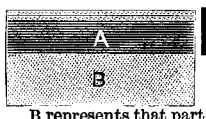
A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent.

A pamphlet, containing full directions for obtaining United States patents sent free. A handsomely bound Reference Book, gilt edges, contains 140 pages and many engravings and tables important to every patentee and mechanic, and is a useful hand book of reference for everybody. Price 25 cents, mailed free.

Address
MUNN & CO.,
Publishers SCIENTIFIC AMERICAN,
37 Park Row, New York.
BRANCH OFFICE—Corner of F and 7th Streets, Washington, D. C.

© 1879 SCIENTIFIC AMERICAN, INC



RUBBER BACK SQUARE PACKING.

BEST IN THE WORLD.

For Packing the Piston Rods and Valve Stems of Steam Engines and Pumps.

B represents that part of the packing which, when in use, is in contact with the Piston Rod.
A the elastic back, which keeps the part B against the rod with sufficient pressure to be steam-tight, and yet creates but little friction.
This Packing is made in lengths of about 20 feet, and of all sizes from ¼ to 2 inches square.

JOHN H. CHEEVER, Treas. **NEW YORK BELTING & PACKING CO.,** 37 & 38 Park Row, New York.

A TEN DOLLAR GOLD-MOUNTED REVOLVER FOR $2.75

READ THIS!

G. W. TURNER & ROSS: — *Dear Sirs,—I write you concerning the Czar Revolver I ordered of you. It is all and more than you claim for it; I have tried almost all kinds, but the Czar is far superior to them all in every respect. I can cut a "daddy dollar" one hundred yards with it, and shoot as deep in wood as a rifle will. I am more than satisfied.* S. E. SEARS, *Sabina, O.*

Beautifully hand-engraved rubber stock, octagon barrel, fluted cylinder, positive stop, Russian model grip, front and rear sights, full nickel plate, and the cylinder and base pin elegantly plated with 18 karat gold.

Uses extra long Rifle Cartridges.

The best Revolver for hunters, police, self-defence, and target shooting. Equal in every respect to the best $10 Revolver in the market as such, or money refunded.

The Czar is made of the finest **English steel**, and has an **extra long barrel**, THE BEST AND FREEST AS LONG AS THE CYLINDER, and is fitted as carefully as a Creedmoor rifle. **The Czar has both front and rear sights**, the front sight being the famous "*California knife blade sight*," the finest muzzle sight made. The **Czar** kills farther than an ordinary Revolver will *shoot*; it will bring down a squirrel from out of the tallest tree; it is a dead shot at 100 yards. The Czar has a similar shaped stock to the Smith & Wesson 38 caliber, which gives the finest "GRIP" obtainable. It is engraved throughout in the most exquisite manner; the work on the frame being so fine as to resemble **frosted silver**. The effect of the gold and nickel plate and the dark engraved rubber stock is beautiful beyond description. WE GUARANTEE IT EQUAL TO A COLT OR SMITH & WESSON *every way.* ☞ *This is no* **humbug** *advertisement.* **We prove** what we say. We will send the Czar Revolver with *privilege of examination*, on receipt of the express agent's guarantee that it will be returned **free** if not taken.

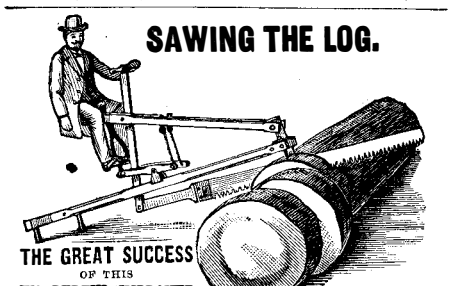
Over 4,000 testimonials rec'd.
READ THIS.

G. W. TURNER & ROSS:
Gents,— The Czar is here all right; many thanks. I have tried it thoroughly, and if it can be beat, I would like to know by whom and by what. I have tried many patterns and it is equal to the very best. I have seldom, if at all, made better shots at 250 yards with my best rifles. Respectfully yours, A. E. MAY. Ravenna, Md.

The Czar Revolver is exactly represented by this picture, which is just about one-half the length of the Revolver itself. It is the most beautiful and accurate weapon *and the biggest bargain* ever produced in this country, and is warranted equal in every way to any $10 Revolver. **Caution.**— Several unprincipled skalawags have copied our former advertisement, and offer a cast-iron imitation of the Czar (with a fire gilt cylinder), for a less price. Beware of them; the unheard of sale of the Czar tempted the cupidity of the dishonorable imitators. **Prices.**— In treble nickel-silver plate, gold mounted, hand engraved, *rubber* stock, 4 inch barrel, **$2.75**; in *Ivory* stock, **$3.75**; in *Pearl* stock, **$4.50.** Sent by express to any address on receipt of price, or by *registered* mail *prepaid* for 25 cts. extra. For **$1 extra** we will furnish an extra **8 inch** Target Barrel elegantly rifled; the barrels can be instantly changed, and the Czar with 8 inch barrel will shoot equal to a rifle at 100 yards. For **$2 extra** we furnish the extra 8 inch barrel and an adjustable **Rifle Stock**, which makes the Czar the equal in every respect of any $15 Pocket Rifle. The Czar loads and ejects cartridges without removing cylinder. Uses regular metallic cartridges which are sold everywhere; cylinder revolves when hammer is raised. When cash comes with order we give *free* a box of extra fine, long range target cartridges. Address, **C. W. TURNER & ROSS,** 16 & 17 DOCK SQUARE, BOSTON, MASS., *Sole Manufacturers.*

YOUR NAME and ADDRESS on **50** Gilt, Duplex, etc., Cards, in case, **15c.** DAVID BROS., Northford, Ct.

SAWING THE LOG.



THE GREAT SUCCESS OF THIS WONDERFUL IMPROVED Labor Saving **RIDING SAW MACHINE** is fully demonstrated by the number in use and the present demand for them. It saws Logs of any size. **One man** can saw **more** logs or cord wood in one day and **easier** than two men can the old way. It will saw a two foot log in three minutes. **Every Farmer needs one.** Township agents wanted. Send for Illustrated Circular and Terms.

Address W. W. BOSTWICK & CO., 178 Elm St., Cincinnati, O.

WE WANT A FEW MORE SALESMEN To Sell to Dealers *Samples free* **CIGARS** Send 3c. stamp to insure answer. S. FOSTER & CO., Cincinnati, O.

60 Pin-a-4, Photo, Gilt-Edge, etc., Cards, and **1** Hudson Valley Chromo, **10c.** DAVIDS & Co., Northford, Ct.

A New Spinning Band.

ROWBOTTOM'S PATENT DOUBLE LOOPED SPINNING BAND. Suitable for all kinds of Spinning and Doubling Frames for Woolen, Worsted, Cotton, Flax, or other fibrous substances. **IS FREE FROM KNOTS,** neat, speedily adjusted, runs steadily, and avoids the annoyance of Lint. Price, fifty cents per pound, delivered at the mill. Sample orders solicited. State kind of machinery and diameter of Driving Cylinder. **STODDARD, LOVERING & CO., Sole Agents, No. 10 Milk Street, Boston, Mass.**

FOR SALE.—One Woodworth Planer. Plane and Groove 24 inches wide. HARRIS & FLINT, Danbury, Conn.

PRIZE MEDAL, PARIS, 1878.

MAKE and SAVE MONEY

BY USING THE CELEBRATED

MODEL PRINTING PRESS

Any smart boy can readily manage it and do hundreds of dollars worth of work every year. It will save BUSINESS MEN all their printing bills. Presses for Business Printing $6 to $22. Card Presses as low as $3. Rotary foot and steam power presses $100 to $160. 7,000 now in use. Send 10 cents for handsome illustrated 124-page Instruction and Specimen Book, entitled

HOW TO PRINT

and copy of MODEL PRINTER'S GUIDE, with all the particulars. J. W. DAUGHADAY & CO., Inventors and Manufacturers, 723 Chestnut Street, Philadelphia.

"The Model Press surpasses anything we ever expected. It has about paid for itself in two weeks.—BENSON & McGILL, Hartwell, Ga." "I would not take $100 and be without the Model Press. It has netted me in less than three months over $200.—J. H. STARR, Hartford, Conn." "No investment will pay as well as a Model Press. In my own business I have saved about $300 a year by its use.—B. J. BICKNELL, Memphis, Tenn."

$1000. REWARD

For any Washing Machine that will Wash Cleaner, Quicker, with Less Labor and Wear and Tear of Clothes than the

ROBBINS FAMILY WASHER AND BLEACHER,

The Only Perfect Self-Operating Washer in the World.

No rubbing required. No more yellow clothes, nor hard work on washing day. No more rubbing clothing full of holes. No more lame backs for farmers' wives washing harvest shirts. Seeing is believing, and if you will try it once you will never again wash without it, nor use any other washing machine.

IT IS THE BEST IN THE WORLD, and will wash anything, from a lace curtain to a horse blanket, and cannot get out of order.

Good Agents Wanted, both Male and Female, to whom Liberal Inducements are Offered.

AGENTS CAN MAKE FROM $10 TO $100 PER WEEK.

INDISPUTABLE EVIDENCE.

"A Splendid Washing Machine."

This is what they call the Robbins Family Washer at the home of the Business Manager of *Farm and Fireside.* Heretofore it required one woman a whole day, from early morn till late at night, to finish the washing, and an extra girl to cook. But since we got a Robbins Washer one girl attends to the washing, cooks dinner at the same time, and has all the clothes hung out to dry, and tubs, wringer, and everything put away before 12 o'clock noon. We wish we could tell our subscribers how delighted they are at our house with this simple washer, and also get them to understand that we write this simply and entirely for their benefit, and NOT at the solicitation of the manufacturers, nor with their knowledge or consent; but we write this to let our readers know that the Robbins Washer has actually proven to be an article that does all the manufacturers claim for, and really does away with a great part of the drudgery required in washing clothes. We would pay many times the price asked rather than do without one. We have also noticed that it requires less soap than formerly, so that the saving in the soap will in a short time pay for the machine.

We advise our readers to examine the advertisement on another page and send for a Washer at once.—*Springfield, O., Farm and Fireside, Oct.* 1.

Publisher of *Farmers' Review*, Chicago, Ill., received a sample, and, after giving it a trial, sends for $24 worth for his friends and neighbors.

The publishers of New York *Christian Advocate*, after receiving a sample Washer, says: "It requires to be honestly tried a few times only to convince the housekeeper that she has found a friend and economizer of labor in the Washer. We have confidence in commending it to the attention of our lady readers."

The New York *Witness* says: "Several of our staff have the machines in use, and are well satisfied with them."

New York *Weekly Sun*: "The Robbins Washer and Bleacher is as represented."

The Toledo *Blade* says: "We believe it to be one of the greatest inventions of the age."

The Chicago *Inter-Ocean* says: "The company could not well say less of that truly wonderful article, which is destined at no distant day to work a complete revolution in the method of accomplishing the family washing. We speak from our own knowledge as well as from the testimony of thousands who have already availed themselves of its services."

E. B. Mack, New York, office of the Cincinnati *Gazette*, says: "I have one in use in my house, and it does admirable work."

C. C. Corbett, M.D., New Hope, Ky.—"After trying sample," has had $100 worth."

Robert Engle, Mosherville, Mich.—After using one for six months, sends orders for $100 worth.

E. Hildom, Cuba, N. Y.—After "thoroughly testing it," sends orders $24, $24, $50, $50 worth in succession.

C. . Mather, Burlington, N. Y.—After purchasing sample and "convicing the skeptical ones," orders $24, $75, $50, $50, $24, $65, $24 worth in rapid succession.

L. H. Miller, Mount Kisco, N. Y.—After "thoroughly convincing himself that the Washer is all we claim for it," orders $24, $100 worth.

A. C. Sabin, Glenwood, Iowa.—After "proving the Washer," sends for $130 worth.

E. Wing, Ansonia, Conn.—"Incloses" $24, $24, $24, $14, $24 successively, but says "he has not had time to give it particular attention."

WE COULD FILL THE COLUMNS OF THIS PAPER WITH SUCH EVIDENCE. WILL PEOPLE BUY A HUMBUG THE SECOND TIME?

The above is no boastful offer made only for the sake of selling our Washer, but, on the contrary, we mean exactly what we say, and will really give $1,000 for any washing machine that can be proven better than ours before a competent committee. Any reader who doubts our ability to do all we agree can easily be convinced by referring to the Mercantile National Bank of this city, to any express company in New York, or to the publishers of this paper.

SAMPLES PREPAID TO YOUR NEAREST RAILWAY EXPRESS OFFICE in any part of the United States east of the Mississippi and Missouri Rivers, also Kansas and Nebraska, for $3.50. West of the line as follows: In Dakota, at Bismarck or Yankton, for $3.50; in Wyoming, at Cheyenne, for $3.50; in Idaho, at Franklin City, for $4.50; in Colorado, at Denver or Pueblo, for $4; in New Mexico, at Santa Fe, for $5; in Arizona, at Prescott, for $8.50; in Utah, at Ogden, for $4; in Nevada, at Virginia City, for $5; in Louisiana, at New Orleans, for $3.50: in Arkansas, at Little Rock, for $3.50; in Texas, at Corsicana, for $4.50; at Texarcana, Denison, or Sherman, for $3.50. For the Pacific coast we deliver No. 1 at San Francisco, Sacramento, Marysville, or San Jose for $4. Our reason for so doing is to induce people to investigate this matter, feeling assured that a trial will secure an Agent for us.

Send for a sample and secure A BUSINESS THAT WILL PAY YOU WELL.

No article in the world has so much MONEY IN IT FOR AGENTS as this Washer.

When you order or write, mention this paper.
Address

BISSELL MFG. CO., 50 Barclay St., N. Y.

WALL STREET SYNDICATES.

The Syndicate System offers the best guarantees for success in stock speculations. Thousands of investments from **$10** to **$2,500** are consolidated and operated as one immense capital; profits equitably divided monthly. Shareholders have all advantages of unlimited capital and rare experience. **"How they make money in Wall Street."** Circular sent free. Address **Allen, Jordan & Co., Bankers and Brokers, 54 Wall Street, N. Y.**

Hydraulic and Jack Screws.

ALBERT BRIDGES, 46 Cortlandt St., New York.

WANTED,

First-class mould maker, for brass or iron. Address care Box 387, Cincinnati, Ohio.

THE PHONOGRAPH SET TO MUSIC.

The Phonographic Piano.—A Most Wonderful Invention.

The Phonographic Piano has been called the most marvellous mechanical invention of the age. It will play any tune that ever was written, in a melodious and pleasing manner. Difficult and simple music produced in a masterly style, and it can be played by a child as well as by a grown person, and will furnish music for singing schools and social gatherings of any description, playing hour after hour, without any knowledge of music being required in the operation. The most wonderful of all musical inventions; a machine which in a purely mechanical manner produces the most difficult and exquisite music, Waltzes, Polkas, Marches, &c., &c., without any practice or knowledge of music whatever; far superior to any music-box, even though it costs thousands of dollars; for their is no limit whatever to the number of tunes it will play. This instrument is on the principle of the wonderful Phonograph. It has just been perfected (the accompanying cut shows it in its improved form), and is having the largest sale ever obtained by a musical instrument in the country. It has solid metal cases in imitation of green bronze; the notes or bars (the music producers are metal, on same principle as a tuning-fork, which produce the clearest and most melodious notes, and never get out of tune; the bars are struck by strikers, the same as the wires are in a Piano, only they work automatically instead of by the fingers. The strip of prepared paper in which the tune is stamped or perforated, is about 10 inches wide, and as it passes through the rollers and over the keys the strikers spring through the perforations in the paper and strike the right note; this is all done automatically without any assistance from the operator (except turning the rollers), and the tune is played as perfectly as by the most expert musician. It would be one of the most appropriate presents to make anyone, especially where there is no Piano. In point of execution and fineness of tone, it will compare favorably with a fine music-box, and its capacity is unlimited. We predict for this instrument a most wonderful sale. It is going faster than any musical instrument ever invented. Its action is perfectly **marvellous.** The music is superb, and everybody delighted. No knowledge of music required, and a child can operate it and furnish music for any occasion. Make your child a sensible present, one which will amuse and instruct not only the child but the whole household. The price of the Phonographic Piano is only **$5.** and a selection of popular tunes goes with each instrument. Boxed *free*, and sent to any address on receipt of price Address **The Massachusetts Organ Co., 43 Washington Street, Boston, Mass., U. S. A.**

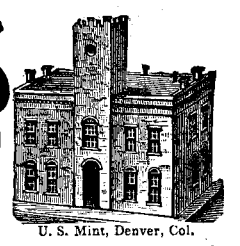
CITY LOTS

Opera House, Denver, Col.

25x125 FEET

SITUATED IN NORTH DENVER,

FREE!



U. S. Mint, Denver, Col.

EVERY OTHER LOT ABSOLUTELY FREE! ☞ WARRANTEE DEED WITHOUT RESERVE.

Denver now has a population of 40,000. Great cities are the outgrowth of great countries. Twenty years ago Denver was a small trading post on the frontier, now it is a large city, with numerous Churches, Hotels, Theaters, Street-railroads, Gas-works, Water-works, Gold and Silver Smelting and Refining Works, with a United States Mint, and is the great Railroad Center of the West. There are seven First-class Railroads now running and connecting with all the Principal and Branch Railroads from Maine to California. It is the Capital of Colorado, naturally the richest State in the Union, and located in about the geographical center of the United States. The climate is charming, with the best water and purest air in the world, and the scenery is unexcelled for beauty and grandeur. It is surrounded by the richest Gold, Silver, Copper, Iron, Lead, and Coal Mines and Agricultural Lands in America. It is now the headquarters for Colorado, Kansas, Nebraska, New Mexico, Wyoming, Nevada, Arizona, and Northern Texas. The rich mineral and agricultural resources of this vast country will make Denver the largest and wealthiest city in the West.

WHY LOTS ARE GIVEN AWAY.

As the tide of immigration is now in this direction, it is the Company's interest to have people locate in Denver and on their property. To encourage emigration here, the Company will give to any one sending their name and address a warrantee deed, in fee simple, for one or more lots in North Denver, situated in Weld County, State of Colorado, in immediate view of this beautiful city, the only charge being one dollar to pay the Notary Public fees for acknowledging deed and conveyance. The Company does not give every lot away, but each alternate one, and does not expect that every person who gets a lot in North Denver will come here, but a great many will, and they will induce their friends to follow. The increased population will soon make this property very valuable, and this Company retain each alternate lot, which they hold at prices varying from $25 to $500, according to location. For this reason the above proposition is made. The deeds are unconditional, not requiring any one to settle or improve, but with full power to transfer and deed to others. The limit to any one person taking advantage of this offer is five lots. This **property is not hillside, mountain, or swamp, but is level, fertile,** and has advantages for building upon too numerous to mention. Full and satisfactory information, with indorsements from our best citizens, will be furnished.

CERTIFICATE OF TITLE.

I, W. C. SANDERS, County Clerk and Recorder within and for said County and State, do hereby certify to the above and foregoing to be true, and title complete to the land therein described according to the records in my office. I further certify there are no abstracts or transcripts of judgments, taxes or other liens standing against said land. In testimony whereof I have hereunto set my hand and affixed my official seal this 2d day of August, A. D. 1879.

W. C. SANDERS, County Clerk and Recorder.

[SEAL.] State of Colorado, } ss. County of Weld. }

INSTRUCTIONS.

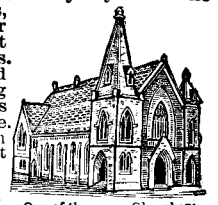
This Company will send by return mail, to any one sending within sixty days from the date of this paper their names, P. O. address, County and State, plainly written in full, a clear warrantee deed to a lot 25 feet front by 125 feet deep in North Denver, Colorado, clear of all taxes.

Applications for city lots must be accompanied with one dollar for each lot to pay cost of making and acknowledging deed, postage, etc. The lots then can be sold and transferred at your pleasure.

Let all improve this opportunity to secure a home in the richest State in the world. Deeds sent to any part of the U. S. and Canadas. Address all letters to

DENVER LAND COMPANY, 449 LAWRENCE ST., DENVER, COL.

High School, Denver, Col.



One of the many Churches

1 Gilt-Bound Autograph Album, **15c. 75** styles Chromo Cards, **10c.** CHROMO CARD CO., Northford, Ct.

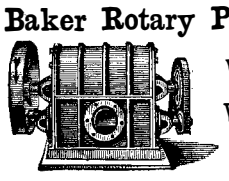
SPARE THE CROTON AND SAVE THE COST.

Driven or Tube Wells

furnished to large consumers of Croton and Ridgewood Water. WM. D. ANDREWS & BRO., 235 Broadway, N.Y., who control the patent for Green's American Driven Well.

TELEPHONE Works 1 mile. Price $3.50. Pat'd Circulars free. HOLCOMB & CO., Mallet Creek, Ohio.

Baker Rotary Pressure Blower.

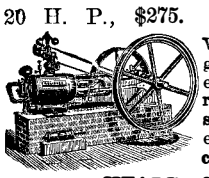


(FORCED BLAST)

Warranted superior to any other.

WILBRAHAM BROS.
2318 Frankford Ave.
PHILADELPHIA

20 H. P., $275. **"RELIABLE"**



Vertical and Horizontal Engines, with Waters' Governor, equal to any in simplicity, durability, and efficiency. Other sizes from 10 to 30 H. P. at prices equally low. For illustrated circular, address

HEALD, SISCO & CO., Baldwinsville, N. Y.

BUSINESS WANTED.

The advertiser will purchase established business for removal, or will assist inventors to introduce articles of merit—Hardware. Address P. O. Box No. 37, New Haven, Conn.

WANTED.—PRESS FOR, OR WILL SELL PATENT of washboard. Best out. T. KEHOE, Owensboro, Ky.

SEEDERS AND PLANTERS.

Attention is called to the notice under the head of "New Books," in the issue of this paper of Aug. 30, 1879, descriptive of a carefully prepared Digest of the entire class of Seeding Machines and Implements, granted from A. D. 1860 to January, 1879, embracing nearly 4,000 patents chronologically arranged and indexed, and the official classification of (34) sub-divisions, with a General Alphabetical Index of all, including Reissues, Extensions, and Additional Improvements. Libraries, Attorneys, Manufacturers, and Inventors will find this book invaluable. Address JAMES T. ALLEN. U. S. Patent Office, Washington, D. C.

© 1879 SCIENTIFIC AMERICAN, INC

Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

ROSE'S MACHINIST.

THE COMPLETE PRACTICAL MACHINIST:

Embracing Lathe Work, Vise Work, Drills and Drilling, Taps and Dies, Hardening and Tempering, the Making and Use of Tools, etc., etc. By Joshua Rose. Illustrated by 130 engravings. In one Volume, 12mo, 376 pages. Price $2.50.

CONTENTS.

CHAPTER I. LATHE AND MACHINE TOOLS.—Round-Nosed Tools; Square-Nosed Tools; Holding Tools; Side Tools for Iron; Front Tool for Brass Work; Side Tool for Brass Work. II. CUTTING SPEED AND FEED.—Tables of Cutting Speeds and Feeds; Table for Steel; Table for Wrought Iron; Table for Cast Iron; Table for Brass; Table for Copper. III. BORING TOOLS FOR LATHE WORK.—Boring Tool for Brass; Boring Tool Holders. IV. SCREW-CUTTING TOOLS.—Hand Chasing; To make a Chaser; To Calculate the Gear Wheels necessary to cut a Thread in a Lathe. V. GENERAL OBSERVATIONS ON LATHE WORK.—Lathe Dogs and Drivers; Emery Grinders; Centering Machine; Lathe Work; Emery Cloth and Paper. VI. TURNING ECCENTRICS.—Turning Cranks; To Chuck a Crosshead; Turning Pistons and Rods; Piston Rings; Ball Turning; Cone Plate for Boring in the Lathe; To turn a Pulley; Turning and Fitting Tapers; Belts; Oiling and Greasing of Belts; Directions for Calculating the Width of Belts required for Transmitting Different Numbers of Horse Power; Directions for Calculating the Number of Horse Power which a belt will Transmit, its Velocity and the Number of Square Inches in Contact with the Smallest Pulley being Known. VII. HAND TURNING.—Roughing Out; The Graver; The Heel Tool; Brass Work; Scrapers; Lathe Chucks. VIII. DRILLING IN THE LATHE.—Half-Round Bits; Cutters; Reamers; Shell Reamers. IX. BORING BARS.—Small Boring Bars. X. LAPS.—Allowance for Shrinkage; Crank Pins; Chucking Brasses; Slotting Machine Tools. XI. TWIST DRILLS.—Feeding Drills; Drills and Drilling—Flat Drills; Drilling Hard Metals; Slotting or Keyway Drills; Pin Drills; Countersink Drills. XII. TOOL STEEL.—Forging Tools; Tool Hardening and Tempering; Hardening; To Harden Springs; Case Hardening Wrought Iron; To Case Harden Cast Iron; To Harden Malleable Iron; The Crystallization of Wrought Iron; The Wear of Metal Surfaces; Annealing or Softening; Mixtures of Metals. XIII. TAPS AND DIES.—Adjustable Dies; Dies for Use in Hand Stocks. XIV. VISE WORK.—TOOLS.—Calipers; The Square; The Scribing Block; Chipping; Filing; Emery Paper; Tools for Scraping Surfaces; Vise Clamps; Pening; Fitting Brasses to their Boxes; Fitting Link Motions; Fitting Cylinders; Scraped Surfaces; To Make a Surface Plate; To Cut Hard Saw Blades; To Refit Leaky Plugs to their Cocks; Refitting Work by Shrinking it; To estimate the Weight of a Casting from the Weight of the Pattern; Grades and Speeds for Emery Wheels; Threads of Gas or Steam Pipes; Steam and Water Joints; To Make Spiral Springs; Hardening; Tempering. XV. FITTING CONNECTING RODS.—Drifts; Reverse Keys. XVI. MILLING MACHINES AND MILLING TOOLS. XVII. TO CALCULATE THE SPEED OF WHEELS, PULLEYS, ETC. XVIII. THE SLIDE VALVE.—Movements of Piston and Crank; Steam Supply; To Measure the Throw of an Eccentric. XIX. HOW TO SET A SLIDE VALVE. XX. PUMPS.—Suction Pumps; Force Pumps; Piston Pumps.—INDEX.

We also publish

The Modern Practice of American Machinists and Engineers. By E. P. Watson. Illustrated by 86 engravings. 12mo, $2.50

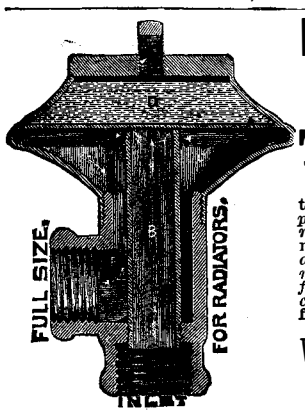
A Manual of the Hand Lathe. By E. P. Watson. Illustrated by 78 engravings. 12mo, . . . $1.50

Amateur Mechanics' Workshop. A treatise containing plain and concise directions for the manipulation of Wood and Metals, including Casting, Forging, Brazing, Soldering, and Carpentry. By the author of the "Lathe and its Uses." Third edition. Illustrated. 8vo, ... $3.00

The above, or any of our Books, sent by mail, free of postage, at the publication prices.

Our new and enlarged CATALOGUE OF PRACTICAL AND SCIENTIFIC BOOKS—96 pages, 8vo—and other Catalogues, sent free to any one who will furnish his address.

HENRY CAREY BAIRD & CO.,
Industrial Publishers, Booksellers, and Importers,
810 WALNUT STREET, Philadelphia.



HAWES' Steam TRAP.

We GUARANTEE this trap to *work perfectly satisfactorily.* Order one; if not satisfied *return at our expense.* The *monthly saving in fuel is more than cost of trap.* Send for circular.

Welch & Lawson,
176 Centre St.,
New York.

Mill Stones and Corn Mills.

We make Burr Millstones, Portable Mills, Smut Machines, Packers, Mill Picks, Water Wheels, Pulleys, and Gearing specially adapted to Flour Mills. Send for catalog e.

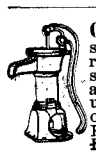
J. T. NOYE & SON, Buffalo, N. Y.

MICROSCOPES, Opera Glasses, Spectacles, Meteorological Instruments, at greatly reduced prices. Send three stamps for Illustrated Catalogue. R. & J. BECK, Philadelphia, Pa.

CARNEGIE BROS & CO
+UNION IRON MILLS
PITTSBURGH PA.
WROUGHT IRON BEAMS
CHANNELS TEES & ANGLES

The attention of Architects, Engineers, and Builders is called to the great decline in prices of wrought
STRUCTURAL IRON.
It is believed that, were owners fully aware of the small difference in cost which now exists between iron and wood, the former, in many cases, would be adopted, thereby saving *insurance* and avoiding all risk of *interruption* to *business* in consequence of fire. Book of detailed information furnished on application.

$10 to $1000 Invested in Wall St. Stocks makes fortunes every month. Book sent free explaining everything.
Address BAXTER & CO., Bankers, 7 Wall St., New York.



GOULD'S HAND AND POWER PUMPS should be used by every household, factory, railroad, steamboat, or mine, and will give satisfaction. They make them for all purposes and uses. Illustrated catalogues furnished upon application. Kept by all dealers throughout the country. THE GOULDS M'F'G CO., Factory, Seneca Falls, N. Y. Warehouse, 15 Park Pl., N.Y. ☞ *Inquire for Goulds' Pumps.*

BOILER COVERINGS.

WITH THE "AIR SPACE" IMPROVEMENTS.

THE CHALMERS-SPENCE CO., Foot E. 9th St., New York. Sole owners of the Air Space Patents.

J. LLOYD HAIGH,
Manufacturer of
WIRE ROPE
of every description, for Railroad and Mining Use, Elevators, Derricks, Rope Tramways, Transmission of Power, etc. No. 81 John St., N. Y. Send for price list. Plans and Estimates furnished for Suspension Bridges.

ICE AT $1.00 PER TON.
The PICTET ARTIFICIAL ICE CO.,
LIMITED,
Room 51, Coal and Iron Exchange, P. O. Box 3083, N. Y.

$3 Printing Press
Prints cards labels &c. (Self-inker $5) 13 larger sizes For business or pleasure, young or old. Do your own advertising and printing. Catalogue of presses, type, cards, &c., for 2 stamps. Kelsey & Co. Meriden, Conn

Pyrometers, For showing heat of Ovens, Hot Blast Pipes, Boiler Flues, Superheated Steam, Oil Stills, etc.
HENRY W. BULKLEY, Sole Manufacturer,
149 Broadway, N. Y.

Working Models
And Experimental Machinery, Metal or Wood, made to order by J. F. WERNER, 62 Centre St., N. Y.

OPEN BACK PRESSES.
STILES & PARKER PRESS CO., Middletown, Ct.

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.

COLUMBIA BICYCLE.
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. It augments three-fold the locomotive power of any ordinary man. Send 3c. stamp for 24 page catalogue, with price list and full information.
THE POPE M'F'G CO.,
89 Summer Street, Boston, Mass.

Pond's Tools,
Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

$2 WATCHES. Cheapest in the known world. Agents wanted. Address COULTER & CO., Chicago.

ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free.
T. NEW, 32 John Street, New York.

THE EMERSON PATENT INSERTED TOOTH & DAMASCUS TEMPERED $100.00 SAWS
GOLD PREMIUM SAWS ARE SUPERCEDING ALL OTHERS EMERSON SMITH & CO'S SAWS
SEND YOUR FULL ADDRESS FOR SAWYERS OWN BOOK (FREE) TO BEAVER FALLS PA.

STEAM PUMPS.

HENRY R. WORTHINGTON,
239 Broadway, N. Y. 83 Water St., Boston.

THE WORTHINGTON DUPLEX PUMPING ENGINES FOR WATER WORKS—Compound, Condensing or Non-Condensing. Used in over 100 Water-Works Stations.
STEAM PUMPS—Duplex and Single Cylinder.

Price list issued Jan. 1, 1879, with a reduction exceeding 30 per cent.

WATER METERS. OIL METERS.

WIRE ROPE

Address JOHN A. ROEBLING'S SONS, Manufacturers, Trenton, N. J., or 117 Liberty Street, New York.
Wheels and Rope for conveying power long distances. Send for circular.

WATCHMAN'S IMPROVED TIME DETECTOR, with Safety Lock Attachment. Send for circular to E. IMHAUSER, 212 Broadway, P. O. Box 2875, New York. Beware of buying infringing detectors.

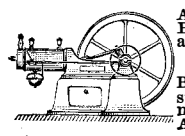
H.W. JOHNS' ASBESTOS

Liquid Paints, Roofing, Boiler Coverings,
Steam Packing, Sheathings, Fire Proof Coatings, Cements, &c. SEND FOR DESCRIPTIVE PRICE LIST.
H.W. JOHNS M'F'G CO. 87 MAIDEN LANE, N.Y.

NEW AND 2D-HAND ENGINES AND BOILERS CHEAP for cash. O. B. GOODWIN, Oil City, Pa.

The J. L. Mott Iron Works,
88 and 90 BEEKMAN ST.,
Manufacturers of
DEMAREST'S PATENT
WATER CLOSETS.
Simple in construction, perfect in operation, thoroughly excluding all sewer gas, and cleanly in every way.

HARTFORD
STEAM BOILER
Inspection & Insurance
COMPANY.
W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.



An engine that works without Boiler. Always ready to be started and to give at once full power.
SAFETY, ECONOMY, CONVENIENCE.
Burns common Gas and Air. No steam, no coal, no ashes, no fires, no danger, no extra insurance. Almost no attendance.

THE NEW OTTO SILENT GAS ENGINE.
Useful for all work of small stationary steam engine. Built in sizes of 2, 4, and 7 H. P. by SCHLEICHER, SCHUMM & CO., 3045 Chestnut Street, Phila., Pa. H. S. Manning & Co., 111 Liberty St., N. Y., Agents.

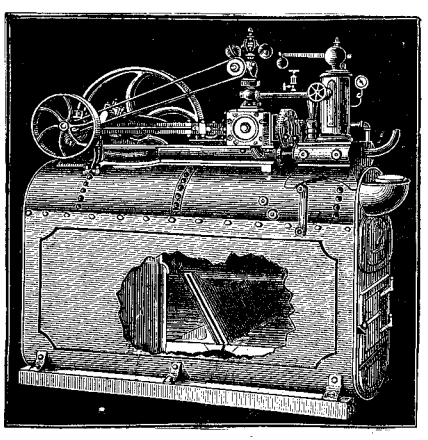
60 Perfumed Chromo &c. cards, name on, 10c. 40 Mixed cards a fine pocket knife, 25c. Autograph Album 50c. Game Authors, 15c. 35 Funcards 10c. Clinton Bros., Clintonville, Ct.

FOR AUTOMATIC CUT-OFF FIXED CUT-OFF & SLIDE VALVE STEAM ENGINES ROCHESTER N.Y. ALSO BOILERS ADDRESS WOODBURY BOOTH & PRYOR.

Cigar Box Lumber,

MANUFACTURED by our NEW PATENT PROCESS.
The Best in the World.
SPANISH CEDAR,
MAHOGANY,
POPLAR.

Also thin lumber of all other kinds, 1/16 to 1/2 in., at corresponding prices. All qualities. Equal in all respects to any made, and at prices much under any to be obtained outside of our establishment. Send for price list.
GEO. W. READ & CO.,
186 to 200 Lewis Street, N. Y.



PORTABLE AND STATIONARY ENGINES and Boilers, 2½ to 15 H. P. Return Flue Boiler, large fire box, no sparks. Do not fail to send for circular to SKINNER & WOOD, Erie, Pa.

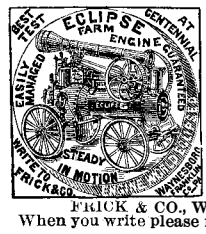
Wood-Working Machinery,

Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines, Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by WITHERBY, RUGG & RICHARDSON,
26 Salisbury Street, Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

ALL KINDS OF WOOD WORKING MACHINERY
IRON WORKING TOOLS
SPECIAL TOOLS,
MANUFACTURED BY THE
H.B. SMITH MACHINE Co.
SMITHVILLE, BUR. CO. N. J.
CIRCULARS FREE.

A GOOD PLAN. Combining and operating many orders in one vast sum has every advantage of greatest capital, with best skillful management. Large profits divided pro rata, on investments of $25 to $10,000. Circular, with full explanations how all can succeed in stock dealings, mailed free. LAWRENCE & CO., 55 Exchange Place, New York.

SHAFTING, PULLEYS, and HANGERS
a specialty. Vertical and Horizontal Engines; also, Nadig's Patent Pulley Moulding Machine. Send for circular to H. NADIG & BRO., Allentown, Pa.



THE
Eclipse Engine
Furnishes steam power for all *Agricultural* purposes, *Driving Saw Mills,* and for every use where a first-class and economical Engine is required. Eleven first-class premiums awarded, including Centennial, '76. Refer to No. 7, issue of '77, No. 14, issue of '78, of SCIENTIFIC AMERICAN, for Editorial illustrations.
FRICK & CO., Waynesboro, Franklin Co., Pa.
When you write please name this paper.

School of Electricity and Inorganic Chemistry,

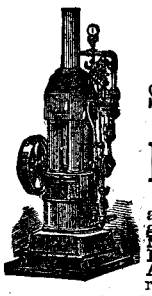
455 FOURTH AVENUE, NEW YORK.
Instruction and Laboratory Practice in Electricity, Inorganic Chemistry, Use of Polariscope, and Construction of Apparatus. Reopens November 3d.
A. FLOYD DELAFIELD, Instructor.

THE TANITE CO.,
STROUDSBURG, PA.
EMERY WHEELS AND GRINDERS.
LONDON—9 St. Andrews St., Holborn Viaduct, E. C.
LIVERPOOL—42 The Temple, Dale St.

ROCK DRILLING MACHINES AND AIR COMPRESSORS,
MANUFACTURED BY BURLEIGH ROCK DRILL CO.
SEND FOR PAMPHLET. FITCHBURG MASS.

FRIEDMANN'S PATENT
EJECTORS

Are the cheapest and most effective machines in the market for
Elevating Water and Conveying Liquids
from Mines, Quarries, Ponds, Rivers, Wells, Wheel Pits; for use in R. R. Water Stations, Factories, etc. They are splendidly adapted for conveying liquids in Breweries, Distilleries, Sugar Refineries, Paper Mills, Tanneries, Chemical Works, etc. Send for illus. catalogue to
NATHAN & DREYFUS,
Sole Manufacturers, *NEW YORK.*



Established 1844.
JOSEPH C. TODD,
Successor to TODD & RAFFERTY,
PATERSON, N. J.,
Engineer and Machinist.
Flax, Hemp, Jute, Rope, Oakum, and Bagging Machinery. Steam Engines, Boilers, etc. Sole Agent for Mayher's New Patent Acme Steam Engine and Force Pumps combined. Also owner and exclusive manufacturer of
THE NEW
Baxter Patent Portable Steam Engine.
These engines are admirably adapted to all kinds of light power for driving printing presses, pumping water, sawing wood, grinding coffee, ginning cotton, and all kinds of agricultural and mechanical purposes, and are furnished at the following low prices:

1 Horse Power,	$135	1½ Horse Power,	$175
2 Horse Power,	225	2½ Horse Power,	250
3 Horse Power,	270	4 Horse Power,	325

Send for descriptive circular. Address
J. C. TODD,
PATERSON, N. J.
Or No. 10 Barclay St., New York.

WOOD WORKING MACHINERY.
PLANING, MATCHING, MOLDING, MORTISING,
TENONING, CARVING, MACHINES.
BAND & SCROLL SAWS
UNIVERSAL AND VARIETY WOOD WORKERS,
&c &c.
J.A. FAY & CO.
CINCINNATI, O. U.S.A.

SHAFTING, PULLEYS, HANGERS, etc.
a specialty. Send for Price List to
A. & F. BROWN, 57-61 Lewis Street, New York.

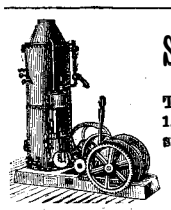
Lathes, Planers, Shapers
Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

WATCHES Reduced Price-List of Gold and Silver *American Watches* mailed free by N. H. White, Newark, N.J.

CARPENTERS' Pocket Companion, $1. *Descriptive Circulars* **Free.**
Address THOS. MOLONEY, Jackson, Mich.

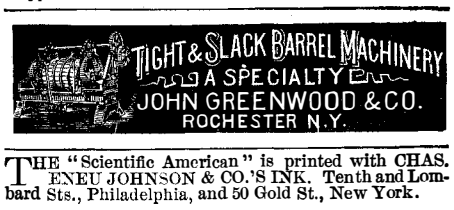
BIBB'S
Celebrated Original Baltimore
Fire-Place Heaters
Mantles, Furnaces, Ranges, etc.
B. C. BIBB & SON,
Office and Salesrooms, 39-41 Light St. Baltimore, Md.; Foundry, Port Deposit, Md. Lowest prices guaranteed. *Best workmanship. Send for Circular.*

WM. A. HARRIS,
PROVIDENCE, R. I. (PARK STREET),
Six minutes walk West from station.
Original and Only builder of the
HARRIS-CORLISS ENGINE
With Harris' Patented Improvements, from 10 to 1,000 H. P.



PATENT
Steam Hoisting Machines.
Four Sizes—4 to 10 Horse Power. The Four Horse Power will raise 1,200 lb. 150 ft. per minute. Other sizes in proportion.
NOBLE & HALL,
ERIE, PA.

JOHN R. WHITLEY & CO.
European Representatives of American Houses, with First-class Agents in the principal industrial and agricultural centers and cities in Europe. London, 7 Poultry, E. C. Paris, 8 Place Vendôme. Terms on application. J. R. W. & Co. purchase Paris goods on commission at shippers' discounts.



THE "Scientific American" is printed with CHAS. ENEU JOHNSON & CO.'S INK. Tenth and Lombard Sts., Philadelphia, and 50 Gold St., New York.

© 1879 SCIENTIFIC AMERICAN, INC